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## BALANCER SETS FOR CHARGING STORAGE BATTERIES.

The introduction of the multiple system of supply in electric lighting was closely followed by the application of the Edison three-wire system, which enabled the energy losses in the supply wires to be cut down where a given size of wire was retained, or to permit wires of smaller capacity to be used for the same losses. This advantage was due to the fact that the supply voltage could be made higher than the normal voltage of the individual energy-consuming units. This system is advantageous wherever it is necessary to put units of lower voltage on sources of supply of higher voltage, as it permits the use of a series connection between units without making each unit dependent upon the operation of the others.

To render this system satisfactory where the load was likely to be unbalanced, and to eliminate the necessity of carrying the middle wire back to the generator, in many cases balancer sets were introduced, consisting of two or more dynamo units connected in series, which could operate either as generators or motors, as circumstances might require. The three-wire supply system is derived from the terminals of these machines. While such balancer sets have been used chiefly for lighting installations, their advantages are equally obvious in the case of other uses of electrical energy. The application of such sets is especially suitable to the charging of storage batteries whose voltage is but a fraction of that of the supply circuit, and yet their application to this purpose seems to have received little attention.

This method was recently the subject of discussion at a meeting of the Chicago Section of the Electric Vehicle Association of America, and it was shown by the author of the paper, Mr. W. H. Noble, that great economy in electrical energy could be secured by this means, and that in the case of garages or other places where large numbers of batteries are to be charged, the initial cost of the apparatus is quite small in comparison to the work to be done. This is due to the fact that the capacity of the balancer set does not need to be as great as the load. The necessary capacity is fixed by the amount of unbalance of the load, and this need never be greater than the capacity of a single battery. Consequently, a balancer set having a current capacity equal to that of a single battery will permit any number of batteries to be charged upon the same circuit. The voltage of a

balancer unit should, of course, be somewhat larger than that of a single battery, and the number of units to be placed in series is determined by the ratio of the supply voltage to the battery voltage.

The use of series resistance to take up the difference in voltage between battery and supply line represents a great waste of energy where this difference in voltage is considerable, and moreover, the waste is multiplied by the number of batteries being charged. In the case of the balancer set, the energy loss is comparatively small, and does not increase with the number of batteries, so that the efficiency of the system increases as the number of batteries is increased.

Probably the reason this system of charging has not been put into greater use is because attention has not been generally called to it. According to statements made at the meeting, not one of the garages in Chicago is using this system, and the same is probably true in most other cities. Since battery voltages are commonly lower than the customary supply voltages, and since even higher supply voltages might be used to advantage in certain cases, it would be well for battery users to look closely into the advantages to be derived from the use of this method.

## STATISTICS OF CALIFORNIA CENTRAL STATIONS.

Much can be learned by the manager of a central-station property by a comparison of the results which he is achieving with those of other properties operating under like conditions. Consequently, the comparative figures for about a dozen California operating companies given on another page of this issue should be of much interest to those concerned with such properties. Unfortunately statistics were not available for carrying the comparison out so as to cover all of the operating companies in the state, but the companies for which information is available cover a large range in size of plant and in area of territory covered.

It will be noted that there is a great diversity in the figures given for ratio of investment to capacity of plant, and to number of inhabitants served. Similar differences are to be noted with respect to the gross income. Such differences are naturally to be expected in a comparison of companies which vary so largely, both in the character of their loads, and in the sources of energy. Hydroelectric plants naturally involve a larger investment than steam plants of the same capacity, and this difference is exaggerated by the usual necessity for a long transmission line. On the other hand, operating expenses are higher for the steam plant, and consequently a larger gross income is necessary in relation to the investment in order to permit an equal rate of return upon the capital.

One characteristic which seems to distinguish the operating companies in this state is the high load-factor. An inspection of the figures for this factor would surprise those who are not familiar with the conditions. It will be noted that the lowest yearly load-factor is 32 per cent, while the largest reaches the remarkable value of 63.8 per cent. Where central stations in other territory have achieved a load-factor of 40 to 50 per cent, it has been considered remarkable, and this, of course, is true in the case of companies whose load consists mainly of lighting, whether it be residential or commercial. Even where considerable power loads exist they are usually carried on the mains for not more than 12 hours per day, and consequently cannot create very large values of load-factor, although contributing to its improvement. It is only where 24-hour industrial loads, night battery charging, street railway service and loads with similar characteristics can be taken on that the ordinary central station can hope to achieve a load-factor of even 50 per cent. In Chicago, where conditions are rather favorable, and indeed have been looked upon as almost as nearly ideal as a city utility can hope to reach, the load-factor is only 43.7 per cent. In California, however, where irrigation pumping reaches a considerable degree and is carried on at a time of the year when lighting requirements are at a minimum, a number of companies have found it possible to exceed a 50-per-cent load-factor, and it will be noted that three of those listed have exceeded 60 per cent. The seasonal fluctuation of the irrigation load is well shown in the load curves for the plant at Roswell, N. Mex., shown on pages 1026 and 1027.

## CONTINUOUS COMMERCIAL SERVICE FOR THE PUBLIC.

No great amount of guesswork is required to look ahead to the time when central stations will furnish practically continuous commercial service to the public, even as they now maintain line voltage at all hours on the distribution system. It may not be necessary to keep a large commercial staff at the office after ordinary business hours are over, but some means of answering the inquiries of the people whenever they arise is sure to be cared for more systematically in the future than it is at present. In some companies, as it is now, when Saturday afternoon arrives the whole sales organization disappears from the premises, and when 5 or 5:30 p. m. arrives on other days it is in many cases very difficult if not impossible to transact business with the company requiring the services of trained commercial men.

In a small town, where everybody knows almost everyone else, it is an easy matter to call up the local manager or to run over to his home for a few moments' discussion of electrical matters, but this is not the case in the larger places. The general public, in calling up the company after so-called business hours, generally gets connected either to the power-plant switchboard booth or to the room devoted to trouble-hunters who are taking time between trips to discipline balky arc lamps or to re-fuse the cutouts in the cellars of Smith,

Jones, et al. Over and over again calls which might lead to the installation of new appliances, more lamps, and even motors, get diverted into channels which block further inquiry for the time being; the prospective customer postpones his arrangements, and perhaps, after following the old-fashioned test of sleeping on the matter before acting upon his first impulse, loses his enthusiasm by morning, and fails to take up the problem with the central station as the day's rush of business starts.

Now this is not the way in which the livest kind of a business concern is going to run its affairs by and by. Some arrangement is sure to be made known to the public by which a fairly large assortment of inquiries about the commercial side of the service can be answered just as readily at 9 p. m. Wednesday as at 9:30 a. m. Thursday. The industry needs in many instances to appreciate more fully that its continuous energy supply, advertised so extensively as knowing no limitations as to hours of application and of profitable earnings, involves, perhaps, a sort of obligation to go a step further and make it easier for the public to do business with it at hours when the public is off duty.

A very important factor in the successful canvassing of new business is the presentation of data and propositions at times when the prospect is receptive. Surely when what might be called an off-office-peak inquiry comes in, the company with adequate provision for handling it promptly stands a far better chance of increasing its business than one whose administrative policy confines the availability of the entire sales staff to "standard" hours of work. A great deal of this work can be done by telephone; in some companies it may be feasible to change about among the staff in handling these inquiries out of hours; and in others a flying squadron of solicitors might be profitably employed for evening service. The same needs which demand continuous service in all-night banks, lunch rooms, etc., will be felt by the central station more and more as time goes on.

## ACCIDENT PREVENTION.

The slogan "Safety First" is becoming so commonplace as to almost lose some of the interest which generally attached to it when it was new. Some central-station companies are giving preference to the slogan "Service First," realizing, however, that the best service can only come about under conditions which eliminate the possibility of accident, and that consequently the latter phrase is inclusive of the former. Accident-prevention work is, however, generally admitted as a very desirable element both in industrial and public service activities. The enormous number of casualties and the loss of life in this country from accidents, both to workmen engaged in industry and to the general public, should cause the public, the workman and the officials of the companies to co-operate towards its lessening.

Public service officials should especially give this matter their attention, because there is no other business which comes so close to the people as that of the public service companies. Every operating plant has its accidents, but many of these are preventable, and a little patient endeavor along proper lines can do much towards reducing the number. This has been demonstrated wherever safety campaigns have been carried out, and it is shown by the statistics given in an article in this issue containing the results for the Insull properties. To attain the greatest results along this line the interest of both employees and public must be aroused, and they must be educated to take proper precautions to prevent accidents. There are many methods of reaching the public, and some of the methods of reaching the employee are illustrated in this article.

Not only are safety campaigns desirable from a humanitarian standpoint, but it has been demonstrated that they pay financially in the lessened claims for disability by employees and for damages from the public. This has been recognized more particularly by operating officials since workmen's compensation laws have gone into effect in many of the states, and the safety idea has consequently received a great impetus.

The preaching of safety by central-station officials should not cease, however, with their employees nor with the general public. A special appeal to customers and prospective customers is very appropriate in connection with the securing of new business. The use of electricity is itself a factor of safety. Electric light is safer than oil lamps or than gas. Electric power, especially when accompanied by individual drive, so that belting and shafting are eliminated from the workshop, is safer than the old styles of mechanical drive. In almost every field of application of electricity its use will be found safer than the method which it replaces.

The tendency of adequate lighting to reduce accidents in workshops and other places has been repeatedly demonstrated by statistics, and has been much appreciated by every shop manager who has made a change from inadequate illumination conditions to one where the lighting is fairly effective. It has also been shown that accidents are more numerous in the winter months of the year when the hours of labor overlap the hours of darkness. If proper artificial illumination were provided this would not be the case. Accident prevention should consequently be a strong talking point with the solicitor who is advocating the installation not merely of electric lighting, but of a lighting system which is properly designed and which utilizes sufficient energy to give the proper amount of illumination. That the cost of such a system is negligible compared with the other operating costs of a factory, and that it is more than repaid by the quality and quantity of work turned out and by the accompanying freedom from accidents, has been often proven. Or it might be more correctly stated that the cost of the system will be repaid in the quality and quantity of the product, and that the decreased liability of accident is obtained gratis. Actual figures from several hundred installations show increased quality in 20 per cent of them, increased quantity in 40 per cent, and a lessening of manufacturing costs in fully one-fourth.

# The National Electric Light Association.

## Program of the Thirty-Eighth Convention, San Francisco, Cal., June 7-11, 1915.

The thirty-eighth convention of the National Electric Light Association will be unique in its setting amid the splendors of the Panama-Pacific International Exposition. Beyond all other expositions ever held before, the electrical illumination of the Panama-Pacific exposition buildings is the most remarkable that has ever been achieved. This feature alone would make the convention location appropriate. While there is no supplemental exhibit of the Class D members, the manufacturers of electrical apparatus, there will be available for the attention of the delegates and visitors a very comprehensive exhibit of electrical products of every description in the exposition buildings.

The accompanying illustration shows the building of the Native Sons of the Golden West, in which the convention of the National Electric Light Association at San Francisco will be held next week. This building is on the east side of Mason Street, between Gary and Post Streets, almost immediately in the rear of the St. Francis Hotel. It is in the heart of the hotel district and within three minutes of most of the hotels. It is an eight-story building constructed of steel and concrete and has two main entrances.

The building has one of the best auditoriums in San Francisco. It has also 14 large lodge rooms and in the basement is a social hall. The association offices and registration booth will be in the lobby on the ground floor of the building, immediately adjoining the main auditorium. This auditorium will accommodate over 1,200 people. The hall in the basement will accommodate about 800. In these two halls will be held the general, commercial and technical sessions of the convention. The public-policy meeting on Wednesday evening will be held in the large auditorium.

The meetings of the Accounting Section will be held on the fourth floor in one of the large lodge rooms. On this floor will be located also a room devoted to various committees and the master of transportation, and a room containing the exhibit of the Meter Committee, and quarters for the new company section committee and the commercial section. On the fifth floor will be offices for the stenographic staff and for the *Convention Daily*.

The following program has been announced for the San Francisco convention:

**Tuesday, June 8, 10 a. m.**

First General Session: Welcome to the City, by Mayor Rolph; Welcome to the Coast, by John A. Britton; Address of President Scott; Report of Committee on Organization of the Industry, by George Williams; Report of the Secretary, by T. C. Martin; Report of Insurance Expert, by W. H. Blood, Jr.; Report of Committee on Progress, by T. C. Martin; Report on Question Box, by S. A. Sewall; Report of Committee on Education, by J. F. Gilchrist; "Revivals," by Paul Lupke.

**Tuesday, 2:30 p. m.**

First Technical Session: Report of Committee on Meters, by C. G. Durfee; Report of Committee on Electrical Apparatus, by L. L. Elden; Report of Committee on Grounding Secondaries, by Paul Spencer; "Application of the Diversity-Factor," by H. B. Gear; "Features of the Lighting of the Panama-Pacific Exposition," by W. D'A Ryan.

**Building of Native Sons of the Golden West, San Francisco, Cal.**

**Tuesday, 2:30 p. m.**

First Accounting Session: Chairman's Address, by H. M. Edwards; Report of the Library Committee, by E. J. Allegaert; Report of the Question Box Committee, by E. C. Scobell; Report of the Committee on N. E. L. A. Uniform System of Accounts, by J. L. Bailey; "Some Opportunities of Public-Utility Accountants," by L. H. Reynolds, auditor, California Railroad Commission.

**Tuesday, 2:30 p. m.**

First Commercial Session: Chairman's Address and Report of Committee on Foreign Relations, by Douglass Burnett; Report of Commercial Section Finance Committee, by J. F. Becker; Report of Membership Committee, by J. G. Learned; Report of Publications Committee, by E. A. Edkins; Report of Sub-Committee on Salesman's Handbooks, by C. J. Russell; Report of Committee on Education of Salesmen, by F. R. Jenkins; Report of Committee on Commercial Department Terminology, by M. E. Turner.

**Wednesday, June 9, 10 a. m.**

First Hydroelectric and Second Technical Session: Address of Chairman of Hydroelectric Committee, by M. R. Bump; Report of Committee on Hydroelectric and Transmission Progress, by T. C. Martin; Report of Committee on Prime Movers, by I. E. Moultrop; "Practice in High-Head Hydraulic Plants," by J. P. Jollyman; "Governor-Effort Analysis," by E. D. Searing; "Oil Burning," by P. M. Downing.

**Wednesday, 10 a. m.**

Second Commercial Session: Address, by C. C. Moore, president Panama-Pacific Exposition; Report of Power Sales Committee on Typical Power Sales Development in the West, by J. H. McDougal; Report of Committee on Merchandising and Recent Development of Electric Appliances, by R. R. Young.

**Wednesday, 10 a. m.**

Second Accounting Session: "Workmen's Compensation Insurance," by R. J. Sullivan, secretary, Travelers' Insurance Company; "Electric-Vehicle Cost Accounting," by W. P. Kennedy; "Standardizing the Accounts of the Pacific Gas and Electric Company," by M. H. Bridges; "Record of Property or Construction Expenditures," by P. R. Ferguson.

**Wednesday, 12:30 p. m.**

Brief Executive Session.

**Wednesday, 2:30 p. m.**

Third Commercial Session: Report of Lamp Committee, by F. W. Smith; Report of Committee on Wiring of Existing Buildings, by R. S. Hale.

**Wednesday, 2:30 p. m.**

Second Hydroelectric and Third Technical Session: Report of Committee on Overhead Line Construction, by Thomas Sproule; "Overhead-Line Construction on the Coast," by J. C. Martin; Report of Hydroelectric Sub-Committee on High-Tension Transmission and Construction, by R. J. McClelland; Report of Hydroelectric

Sub-Committee on High-Tension Apparatus, by W. N. Ryerson; Report of Hydroelectric Sub-Committee on Main-Line Electrification of Railroads, by B. F. Wood.

**Thursday, June 10, 10 a. m.**

Third Accounting Session: Report of Committee on Cost Accounting, by J. H. Gulick; "Analysis of Cost by an Electricity Supply Company for Rate-Making Purposes," by A. D. Spencer and R. W. Symes; "Analytical Accounting for Central-Station Purposes," by O. B. Coldwell; Presentation and Adoption of New Accounting Section By-Laws; Report of the Nominating Committee; Installation of Section Officers.

**Thursday, 10 a. m.**

Fourth Commercial Session: Report of Rate Research Committee, by R. S. Hale; Report of Power Sales Bureau of the Commercial Section, by C. J. Russell; "The Commercial Application of Resistance Furnaces," by C. W. Bartlett; "A Stassano Furnace Installation at Redondo, Cal.," by W. M. McKnight; "Electric Furnace Power Loads," by F. T. Snyder; "Charges for Electric Welding Service," by C. K. Nichols.

**Thursday, 10 a. m.**

Fourth Technical Session: Report of Committee on Terminology, by A. S. McAllister; Report of Committee on Street Lighting, by J. W. Lieb; Report of Committee on Underground Construction, by P. Torchio; "Timber Preservation," by R. A. Griffin; Report of Committee on Accident Prevention, by M. J. Insull; "Opportunities of the Public Service Companies in General Accident Prevention," by C. B. Scott.

**Thursday, 8:45 p. m.**

Public Policy Meeting: Report of the Public Policy Committee, by W. W. Freeman; "Public Service Commission Relationships," by John H. Roemer.

**Friday, June 11, 10 a. m.**

Fifth Commercial Session: Report of Committee on Power Sales Methods; Demonstration of a Power Sale, by C. H. Stevens; Election of Section Officers.

**Friday, 10 a. m.**

Second General and Executive Sessions: Report of Committee on Company Sections, by F. J. Arnold; "Company Section Work," by D. C. Bruce; "The Electric Vehicle and the Central Station," by J. F. Gilchrist and A. J. Marshall; "Electrical Prosperity Week," by J. M. Wakeman; Report of Committee on Doherty and Billings Prizes for Company Section Papers, by P. Lupke; Report of the Committee on Memorials, by T. C. Martin; Report of Committee on President's Address; Report of Committee on Resolutions; Election of Officers.

It is expected that the public policy meeting will be notable in its presentation of subject matter of particular import at this time. The arrangement of sessions is such that there will be ample time for the inspecting of the exhibit buildings. The entertainment committee has arranged for the edification of those in attendance, and the hotel committee has worked out every detail for the comfort of the visitors from the east.

The master of transportation, George W. Elliott, is to be particularly felicited upon the excellent arrangements made for the several special trains making the long trip from the east and taking to San Francisco in every instance an attendance of record-breaking proportions.

Holton H. Scott,
President of the National Electric Light Association.

The officers of the National Electric Light Association are as follows:

Holton H. Scott, President, New York.

E. W. Lloyd, Vice-President, Chicago, Ill.

H. A. Wagner, Vice-President, Baltimore, Md.

L. D. Gibbs, Vice-President, Boston, Mass.

J. S. Bleecker, Vice-President, Columbus, Ga.

T. Commerford Martin, Secretary.

S. A. Sewall, Assistant to Secretary.

W. F. Wells, Treasurer.

H. Billings, Assistant Secretary and Treasurer.

Everett W. Burdett, General Counsel.

George W. Elliott, Master of Transportation .

Executive Committee, Holton H. Scott, H. C. Abell, J. S. Bleecker, Henry G. Bradlee, W. C. L. Eglin, A. C. Einstein, L. D. Gibbs, C. E. Groesbeck, E. W. Lloyd, J. B. McCall, Walter Neumuller, R. S. Orr, W. N. Ryerson, Paul Spencer, and H. A. Wagner.

J. E. Bigham, President Southeastern Section.

O. B. Coldwell, President Northwest Association.

H. A. Fee, President Michigan Section.

L. D. Gibbs, President New England Section.

W. F. Gorenflo, President Mississippi Section.

H. A. Holdredge, President Nebraska Section.

R. E. Lee, President Iowa Electrical Association.

W. E. Long, President Pennsylvania Section.

L. H. Scherck, President Eastern New York Section.

D. R. Street, President Canadian Association.

D. R. Burnett, Chairman Commercial Section.

## Advertising Exhibit at New York Show.

One of the features of the New York 1915 Electrical Exposition will be an advertising exhibit at the main entrance to the Grand Central Palace. The exhibit will be conducted under the auspices of a committee, to the membership of which representatives of all the central stations of that section will be invited.

Members of the electrical industry are cordially invited to submit samples of advertising to be placed by the committee in this gallery. Such examples should be submitted to Cyril Nast, chairman of the committee, Irving Place and Fifteenth Street, New York City.

## World's Copper Production.

According to *L'Economiste Européen*, the production of copper in the world in 1914 amounted to 893,085 tons, a decrease of 91,775 tons from that of 1913. There was a falling off of more than 10 per cent in the output of the United States, Spain, Mexico and Australia, but that of Germany, estimated at 30,000 tons, represents an increase of about 5,000 tons over the preceding year.

# Electricity for Irrigation Pumping.

Of all the varied industries and means of producing wealth, there is none which ever has or probably ever will compare in importance with agriculture. The value of our farm products is far in excess of the value of those from any other source, and is of inestimably greater benefit to the world. And yet in a large part of the country, particularly in the semi-humid and great arid zones, there are thousands of acres of choice land in sage brush that could be made productive by irrigation.

The importance of pumping for irrigation as an electric motor load is well recognized in the West and the connected load of this type has reached large proportions, especially in Idaho and California. Central stations in the Middle West and East, however, have given little or no consideration to this subject, the farmers depending entirely upon natural rainfall, although frequently this is not sufficient for good crops. Data are presented herewith on the practices in several of the important California irrigating districts which illustrate the importance of this field and which can be applied, with results equally as good, in other sections of the country.

Before dealing with the operations in specific localities it may be of interest to review briefly some of the general features of irrigation pumping which are common to practically all western installations.

The practical success of irrigation pumping depends very largely on the class of installation that is made. The cost of power will always be the largest expense factor in pumping and the most careful attention should be given, therefore, to the arrangement and setting up of machinery and to the details of mechanical design, material and workmanship of the equipment. It is generally agreed that the centrifugal pump is the best type to be used, under ordinary conditions, and that electric power supplied through motors, is the most simple, reliable and efficient kind of power that may be used for driving irrigating-pumping machinery.

In most localities in the West strenuous competition is encountered from gasoline-engine-driven pumps and it is usually difficult, at first, to convince the farmer of the greater economy of the electric motor. Usually the only comparison made is between the cost of gasoline and electric energy for a definite period and this comparison, of course, favors the gasoline engine. The folly of basing comparisons on fuel solely is strikingly shown in a recent government report on a group of irrigating installations in Central California. The report shows the total cost per acre-foot of water pumped to average for 17 installations investigated, $7.68 for energy or a total cost of $19.50, including labor, energy, fixed charges, etc. The average price for energy in these 17 instances was 2.5 cents per kilowatt-hour and the average head, including suction, friction and discharge, 115 feet. The same report shows that for 46 gasoline-engine installations the average cost per acre-foot of water pumped for fuel was $2.43, while the total cost was $24.50, a saving of $5.00 per acre-foot in favor of electricity. Fuel cost for the 46 plants is based on an average price of 5.5 cents per gallon for gasoline.

Such savings are typical of electric operation and can be demonstrated in almost every comparison. A typical individual case, showing the economy of electric drive, is that of a Southern California installation of a 25-horsepower motor which replaced a 30-horsepower gasoline engine. The installation was made to deliver 200 inches of water or 1,800 gallons of water per minute against a head of 35 feet total, assuming an efficiency on the pump of 65 per cent and operation of the plant to be 1,800 hours per year:

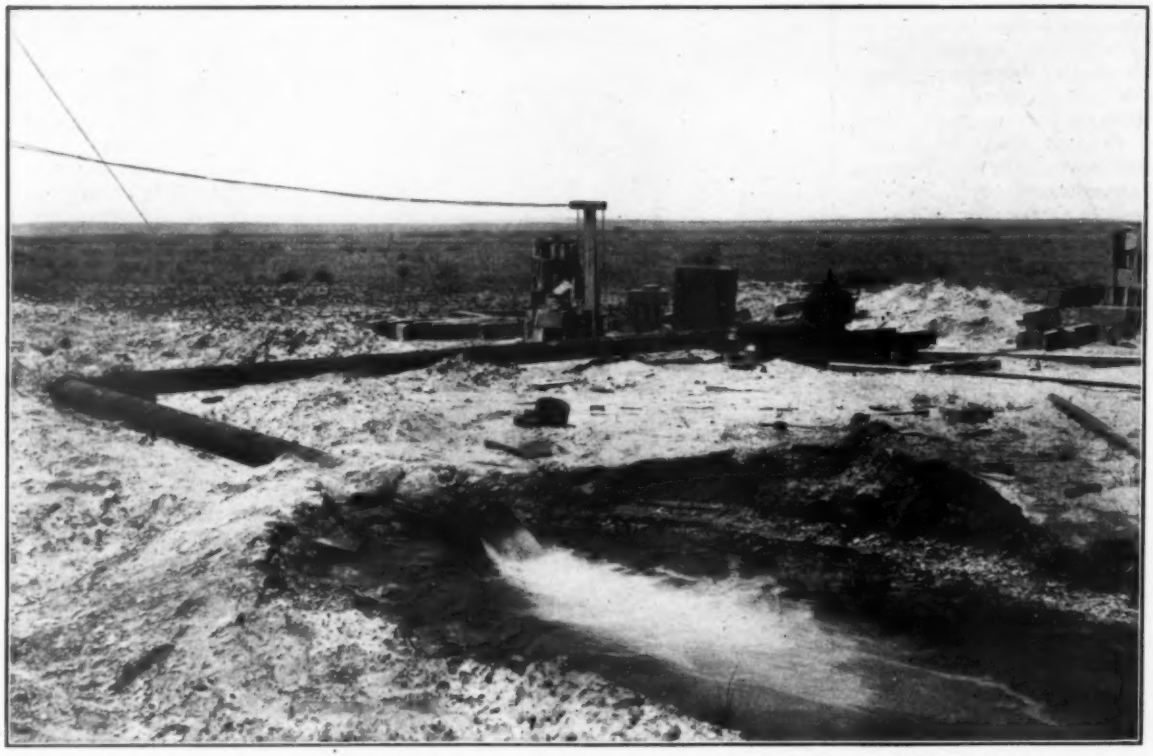


Fig. 1.—Installation in New Mexico With Vertical Pump Delivering About 1,000 Gallons of Water Per Minute.

Fig. 2.—Horizontal Pump Belted to 25-Horsepower Motor, Pumping Out of a River.

COMPARISON OF GASOLINE ENGINE AND MOTOR DRIVE FOR PUMPING.

This is a comparison of installation to deliver 200 inches of water or 1,800 gallons of water per minute against a head of 35 feet total, assuming an efficiency on the pump of 65 per cent and operation of the plant to be 1,800 hours per year:

**Cost of Motor Installation.**

| | |
|---|---|
| One 25-horsepower, 3-phase, 220-volt, 900-revolutions-per-minute motor, complete without base or pulley. | $358.85 |
| One pump with extended base complete for mounting motor | 312.50 |
| Foundation for motor and pumps. | 30.00 |
| Buildings | 50.00 |
| Switchboard and wiring | 35.00 |
| Labor | 75.00 |
| Total | $861.35 |

**Fixed Charges.**

| | |
|---|---|
| Interest 7 per cent | $60.30 |
| Depreciation 7 per cent | 60.30 |
| Taxes and insurance 2 per cent | 17.22 |
| | $137.82 |

**Operation of Electric Motor.**

| | |
|---|---|
| 1,800 hours per year, 24.2 horsepower total load, assuming 90 per cent efficiency on the motor, we have 20 kilowatts for 1,800 hours, or 36,000 kilowatt-hours; 36,000 kilowatt-hours at 2 cents | 720.00 |
| Labor, 0.25 hour per day and repairs | 40.00 |
| Total for operation and fixed charges | $897.82 |

**Cost of Gasoline Engine Installation.**

| | |
|---|---|
| Gas engine, 30 horsepower | $1,250 |
| Belt | 50 |
| Foundation | 25 |
| Gasoline tanks and water piping | 25 |
| Pump | 175 |
| Building | 125 |
| Pump foundation | 25 |
| Labor | 125 |
| Total | $1,800 |

**Fixed Charges.**

| | |
|---|---|
| Interest 7 per cent | $126.00 |
| Depreciation 10 per cent | 180.00 |
| Taxes and insurance 2 per cent | 36.00 |
| | $342.00 |

**Operation of Gasoline Engine.**

Eighteen hundred hours per year, 8 per cent loss in belt makes 24.2 horsepower equal 92 per cent of load; load 26.3 horsepower; one-eighth gallon of distillate per horsepower-hour; 26.3 x 1,800 equals 47,340 horsepower-hours; ⅛ x 47,340 equals 5,920 gallons of distillate; leakage and absorption 5 per cent, 296.0; 5,920 + 296 equals 6,216 gallons of distillate.

| | |
|---|---|
| Lubricating and cylinder oil 0.25 cent per horsepower-hour | $ 118.35 |
| Distillate, 10 cents per gallon | 621.60 |
| Labor, 2 hours per day | 90.00 |
| Repairs | 50.00 |
| Waste and batteries | 25.00 |
| Fixed charges | 342.00 |
| Total for operation and fixed charges | $1,246.95 |

Fig. 3.—Service Lines Entering a Pump House.

In replacing a gasoline engine with an electric installation, and in new installations great care should be exercised in the general arrangement of the machinery and attention should be paid to the size, type, design and efficiency of the different units. The number of units installed should be proportioned so that a delivery capacity of from 30 to 100 per cent can be obtained without creating a demand for power much in excess of the ratio of the water delivered.

For low lifts the pump to be recommended to the customer is the horizontal direct-connected unit which completely eliminates belt friction on bearings from belt pull and the wear and tear from vibration. A type of pump is commonly installed in the West which has a non-overloading impeller, giving constant power characteristics under variable heads. This insures non-overloading of the motor which is an important factor in direct-connected pumps where the head varies, or where different heads are to be pumped against by the same unit, as there is no way of changing the speed of the motor for the different heads, unless a variable-speed motor is used.

Another very important feature of the direct-connected pump referred to is the balancing device which obviates the necessity of set collars but is a complete water balance no matter how much the head varies. This eliminates a great amount of friction. Furthermore this pump has a water-sealed stuffing box which eliminates the leakage of water through the bearings, which is important where the pump is installed in a pit, as in the Southern California district.

Wherever possible double-suction

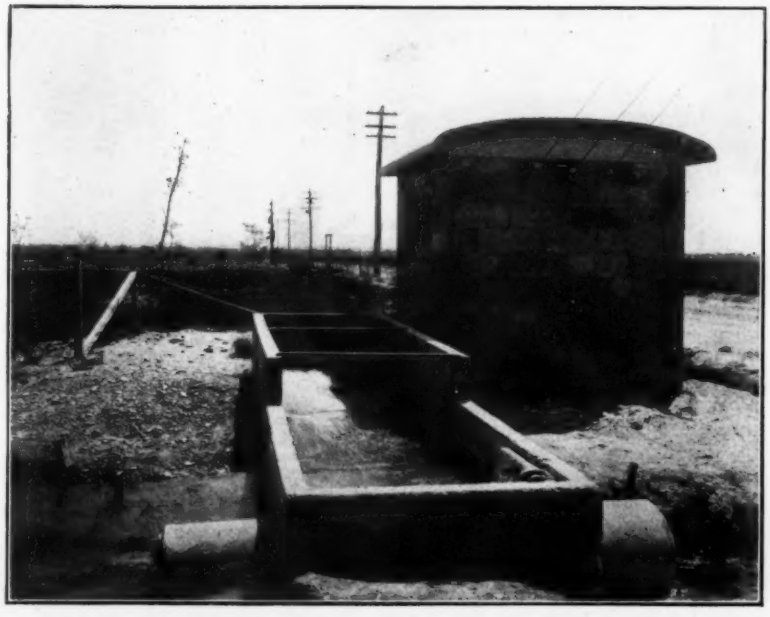


Fig. 4.—Pump House, Service Wires and Concrete Discharge Trough.

impeller pumps should be used, thereby permitting greater speed and securing higher efficiency, less wear, better operating results, and, in the case of the larger pumps, less first cost. Single-suction volute pumps, in any size, are not recommended for heads greater than 80 feet, whereas double-suction volute pumps can be used with good efficiencies for heads up to 150 feet. As a rule pumps should be provided with bronze impellers for speeds above 1,200 revolutions per minute and for heads greater than 100 feet.

The pump runners should be designed for the maximum average head, but the angle of the impellers should be such that with a 30-per cent reduction of head, the pumps would show good operating characteristics.

In the accompanying illustrations are shown typical pump houses. These should be of substantial construction, usually of sheet iron, with floors of concrete, designed to absorb vibration

Fig. 5.—Motor Which Replaced Gasoline Engine, Using Same Belting and Equipment.

as well as carry the weight. In the Southern California district served by the San Diego Consolidated Gas & Electric Company, pump and motor are installed in pits as near the water level as possible. These pits are made from 5 to 15 feet deep and from 8 to 12 feet in diameter, and usually round. They are constructed of concrete, made waterproof and are large enough when finished to allow at least two feet clearance between the machinery and the wall, in any direction.

By installing the pumping units in pits the efficiency of the installation is greatly increased. Often the pumps and motors are set from 5 to 6 feet below the water level, therefore keeping the pump always primed.

Where the water level is so low that the pit construction becomes too expensive then the direct-connected vertical pump is used, but this is not advised where the horizontal set can be used on account of the difficulty of replacing parts, etc.

**Motor Characteristics.**

For driving centrifugal pumps, three types of motors can be used, namely, squirrel-cage induction motors, phase-wound induction motors and synchronous motors. The efficiencies of these machines are practically uniform for similar capacities. Because of serious voltage surges developed by throwing large squirrel-cage motors on a line this type is recommended only for units of less than 50 horsepower. The current required for starting is from 2.5 to 4 times full-load current.

For installations of 50 horsepower or over the phase-wound motor is recommended as the current required for starting is only about 2 to 2.5 times the full-load current and excessive line disturbances are avoided.

There is very little difference between the cost of the squirrel-cage and phase-wound motor. The synchronous motor is often necessary on long transmission lines and where units are above 100 horsepower in capacity. This type of motor often improves line regulation and power-factor and increases the efficiency of the transmission line where other types of motors might greatly impair the service. However, the synchronous motor is somewhat more expensive to install and operate than induction motors and are therefore only installed where conditions make it essential.

The accompanying table gives data on the approximate horsepower required for pumps of different size, lift and efficiency.

With small quantities of water at a high head, the centrifugal pump is very inefficient and where much pumping of this sort is done it is best to look for a more efficient plant. This is also true in deep-well pumping where the water is from 50 to 200 feet below the surface of the ground. A deep-well turbine pump is available which operates inside a large casing at a great depth, but the efficiency of this type also is very low.

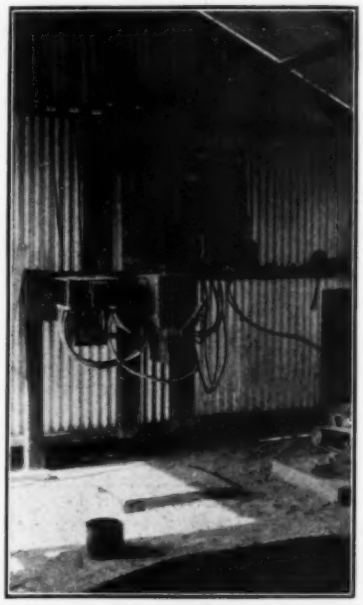


Fig. 6.—Type of Switching Apparatus in Typical Pump House, Southern California.

Wherever possible it is advisable for the central station to have the consumer install a high efficiency plant from, say, 50 to 100 gallons capacity per minute and pump into a reservoir. This reservoir or tank should be capable of holding a 12-hour supply. The reservoir should be built on the highest point of land and if it is sandy so that seepage would be excessive a clay bottom 4 or 6 inches in depth well tamped down, or a light cement lining made of about one part of cement, four parts of sand and one part of gravel will

HORSEPOWER AND PRICE OF PUMPS

| Size of Pump Inches. | Gallons per Minute. | Head in Feet. | Speed of Motor. | Efficiency of Pump in Per Cent. | Horsepower of Motor. | Weight, in Pounds. | Price. |
|---|---|---|---|---|---|---|---|
| 1 | 20 | 20 | 1700 | 35 | 0.5 | 150 | $ 65 |
| 1 | 20 | 45 | 1700 | 35 | 1 | 175 | 75 |
| 1 | 20 | 60 | 1700 | 35 | 2 | 200 | 90 |
| 2 | 66 | 27 | 1700 | 45 | 1 | 200 | 80 |
| 2 | 90 | 40 | 1700 | 45 | 2 | 210 | 100 |
| 2 | 100 | 55 | 1700 | 50 | 3 | 230 | 105 |
| 2 | 110 | 80 | 1700 | 50 | 5 | 285 | 130 |
| 2 | 110 | 105 | 1700 | 50 | 7.5 | 330 | 175 |
| 3 | 200 | 20 | 1120 | 45 | 3 | 550 | 150 |
| 3 | 225 | 35 | 1120 | 45 | 5 | 550 | 150 |
| 3 | 225 | 45 | 1120 | 52 | 5 | 550 | 150 |
| 3 | 250 | 55 | 1120 | 55 | 7.5 | 640 | 175 |
| 3 | 260 | 75 | 1700 | 55 | 10 | 640 | 175 |
| 3 | 275 | 85 | 1700 | 55 | 10 | 640 | 175 |
| 3 | 300 | 105 | 1700 | 50 | 15 | 700 | 200 |
| 3 | 240 | 130 | 1700 | 50 | 15 | 700 | 200 |
| 4 | 350 | 20 | 1120 | 50 | 5 | 750 | 185 |
| 4 | 400 | 30 | 1120 | 55 | 7.5 | 780 | 195 |
| 4 | 400 | 40 | 1120 | 55 | 7.5 | 780 | 195 |
| 4 | 425 | 55 | 1120 | 60 | 10 | 800 | 200 |
| 4 | 450 | 65 | 1120 | 60 | 15 | 830 | 215 |
| 4 | 475 | 75 | 1120 | 65 | 15 | 830 | 215 |
| 4 | 500 | 85 | 1120 | 65 | 20 | 800 | 230 |
| 4 | 550 | 100 | 1120 | 60 | 25 | 1000 | 240 |
| 4 | 500 | 130 | 1120 | 60 | 30 | 1100 | 275 |
| 5 | 600 | 20 | 850 | 55 | 7.5 | 900 | 225 |
| 5 | 625 | 30 | 850 | 58 | 7.5 | 900 | 225 |
| 5 | 650 | 40 | 850 | 60 | 10 | 940 | 230 |
| 5 | 700 | 50 | 850 | 60 | 15 | 960 | 250 |
| 5 | 700 | 60 | 1120 | 65 | 20 | 975 | 245 |
| 5 | 750 | 75 | 1120 | 65 | 25 | 1000 | 265 |
| 5 | 800 | 85 | 1120 | 65 | 30 | 1020 | 275 |
| 5 | 900 | 100 | 1120 | 60 | 35 | 1100 | 290 |
| 6 | 800 | 20 | 850 | 58 | 7.5 | 1250 | 270 |
| 6 | 800 | 25 | 850 | 60 | 10 | 1250 | 270 |
| 6 | 900 | 40 | 850 | 63 | 15 | 1250 | 270 |
| 6 | 900 | 50 | 850 | 65 | 20 | 1400 | 300 |
| 6 | 1000 | 70 | 850 | 67 | 30 | 1450 | 320 |
| 6 | 1100 | 85 | 850 | 67 | 40 | 1520 | 340 |
| 6 | 1000 | 100 | 1120 | 65 | 40 | 1160 | 300 |
| 7 | 1000 | 20 | 850 | 58 | 10 | 1500 | 310 |
| 7 | 1100 | 30 | 850 | 60 | 15 | 1560 | 320 |
| 7 | 1200 | 40 | 850 | 65 | 20 | 1600 | 325 |
| 7 | 1250 | 55 | 850 | 68 | 30 | 1650 | 340 |
| 7 | 1400 | 70 | 850 | 70 | 40 | 1680 | 355 |
| 7 | 1500 | 85 | 850 | 70 | 50 | 1750 | 365 |
| 8 | 1400 | 20 | 850 | 60 | 15 | 2100 | 375 |
| 8 | 1500 | 30 | 850 | 64 | 20 | 2150 | 385 |
| 8 | 1600 | 45 | 850 | 68 | 30 | 2250 | 400 |
| 8 | 1700 | 60 | 850 | 70 | 40 | 2300 | 410 |
| 8 | 1800 | 70 | 850 | 72 | 50 | 2520 | 450 |
| 8 | 2000 | 85 | 850 | 70 | 75 | 2800 | 500 |
| 10 | 2000 | 20 | 690 | 60 | 20 | 2450 | 500 |
| 10 | 2400 | 30 | 690 | 65 | 30 | 2550 | 520 |
| 10 | 3000 | 40 | 690 | 67 | 50 | 3900 | 585 |
| 10 | 3000 | 50 | 690 | 70 | 75 | 3200 | 590 |
| 10 | 3500 | 65 | 690 | 72 | 100 | 3300 | 625 |
| 12 | 3300 | 20 | 580 | 60 | 30 | 3500 | 600 |
| 12 | 3500 | 25 | 580 | 65 | 40 | 3500 | 600 |
| 12 | 3800 | 35 | 580 | 68 | 50 | 3600 | 625 |
| 12 | 4300 | 45 | 690 | 70 | 75 | 3600 | 625 |
| 12 | 4300 | 45 | 690 | 70 | 75 | 3600 | 625 |
| 12 | 4700 | 60 | 690 | 72 | 100 | 3750 | 650 |
| 12 | 5000 | 70 | 690 | 72 | 125 | 3900 | 680 |

render it sufficiently water-tight for all purposes.

In order to insure the ultimate success of irrigation pumping it is of prime importance that the cost of power be made such that the maintenance charge under the pumping project will not prove over burdensome and in this connection some such reservoir arrangement as described above should be given careful consideration. The central station should keep the irrigator fully advised of the best and most approved methods of handling and economically using the water at his disposal and see that practical, flexible and efficient pumping plants be installed.

The accompanying table gives a general idea of the cost of pumping by means of electric motors for different heads and different rates for electric energy.

COST OF PUMPING WATER TO COVER ONE ACRE THREE INCHES DEEP.

| Total Head in Feet. | Cents Per Kilowatt-Hour. 1 | 1.5 | 2 | 2.5 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|
| 10 | 0.064 | 0.096 | 0.128 | 0.160 | 0.192 | 0.256 | 0.320 |
| 15 | 0.096 | 0.144 | 0.192 | 0.240 | 0.288 | 0.384 | 0.480 |
| 20 | 0.128 | 0.192 | 0.256 | 0.320 | 0.385 | 0.512 | 0.640 |
| 25 | 0.160 | 0.240 | 0.320 | 0.400 | 0.481 | 0.640 | 0.800 |
| 30 | 0.192 | 0.288 | 0.385 | 0.481 | 0.577 | 0.768 | 0.960 |
| 35 | 0.224 | 0.336 | 0.449 | 0.561 | 0.673 | 0.896 | 1.122 |
| 40 | 0.256 | 0.384 | 0.513 | 0.640 | 0.769 | 1.024 | 1.280 |
| 45 | 0.288 | 0.432 | 0.577 | 0.720 | 0.865 | 1.152 | 1.442 |
| 50 | 0.320 | 0.480 | 0.641 | 0.800 | 0.960 | 1.282 | 1.600 |
| 55 | 0.352 | 0.529 | 0.705 | 0.881 | 1.056 | 1.408 | 1.760 |
| 60 | 0.384 | 0.576 | 0.769 | 0.960 | 1.152 | 1.536 | 1.920 |

The San Diego Consolidated Gas & Electric Company has developed a large irrigation pumping load and its practices may be considered typical for individual pumping plants. At present the company serves a territory of approximately 400 square miles. In this district there are 273 installations representing an aggregate connected load of 2,664 horsepower. The average kilowatt-hours per year per horsepower connected, for all plants, is 19.8.

The company builds line extensions wherever the installation will warrant, or when the revenue per year amounts to 40 per cent of the cost of the line. The company stands as much of the cost of the line as the installation will warrant and requires the customer to deposit cash sufficient to cover the balance of the cost. As other customers are taken on each pays his pro-rata share of the customer's cost.

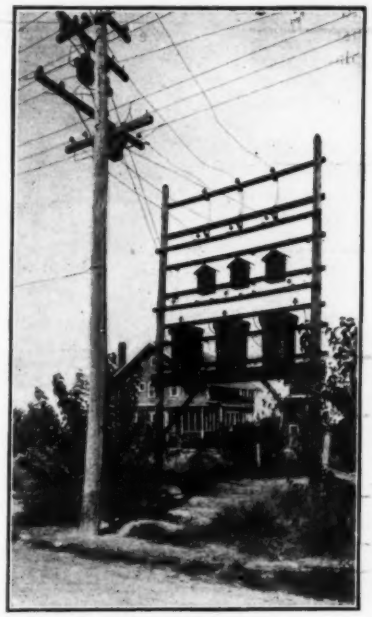


Fig. 7.—Outdoor Transformer Station Near Roswell.

The average cost per mile of line in California is $1,000. The San Diego company uses 35 and 40-foot poles with No. 4 bare copper wire for 11,000-volt lines and No. 6 weatherproof for 2,300-volt lines. Poles are usually spaced 300 feet apart on straight runs.

One man is employed who lives in the geographical center of the district who sets and reads meters and takes care of all trouble. Express companies and banks throughout the district act as agents for the company in collections.

A typical installation in the San Diego district is that of the Lakeside Farmers' Mutual Water Company. Three 25-horsepower motors are direct-connected to pumps which are capable of irrigating 500 acres of alfalfa and fruit land. This plant supplies water for the irrigation of 32 farms. During the past year 210 acres of alfalfa were irrigated, 50 acres of corn and vegetables, 75 acres of fruit land, and water was supplied to 42 residences. The kilowatt-hour consumption for the year, which is typical, was as follows:

| Month | Kilowatt-Hours. |
|---|---|
| January | 460 |
| February | 280 |
| March | 2,310 |
| April | 10,290 |
| May | 12,390 |
| June | 9,890 |
| July | 14,740 |
| August | 12,440 |
| September | 10,030 |
| October | 7,270 |
| November | 2,940 |
| December | 580 |

The average consumption per month was 6,975 kilowatt-hours and the average kilowatt-hour consumption per month per horsepower connected was 93. The average kilowatt-hour consumption per 1,000 gallons pumped was 0.24 for low lift and 0.63 kilowatt-hour for high lift.

The Lakeside is a mutual water company which operates the water plants and sells the water to each farmer in the company. There are two 25-horsepower, squirrel-cage, 440-volt, induction motors each direct-connected to a seven-inch, single-stage, centrifugal pump rated at 1,250 gallons per minute against a head of 38 feet. The third 25-horsepower motor is direct-connected to a 10 by 10 Gould triplex pump which delivers 450 gallons of water per minute against a total head of 144 feet, through a 10.25-inch pipe into a reservoir.

The low-lift plants pump into a water-distributing system consisting of four miles of cement tile line 14 inches in diameter, and four miles of steel pipe

Fig. 8.—Interior Arrangement of Pump House in Southern California.

Fig. 9.—Buildings on Modern California Alfalfa Ranch—Pump House in Foreground.

line 12 inches in diameter. These pumps take the water from 14-foot wells whose average depth is 70 feet and average suction depth 24 feet.

The high-lift pumps operate about 14 hours per day seven months per year and six hours per day for five months of the year.

The alfalfa ground is irrigated eight times each year. This installation was originally driven by a 60-horsepower and a 35-horsepower oil engine burning stove distillate at a cost of four cents per gallon delivered on the ground. Electric service at a higher unit rate is, however, proving much more satisfactory and economical.

The average size motor used by the private irrigating plant is 7.5 horsepower. A typical plant of such size supplied by the San Diego Consolidated Gas & Electric Company, serves about 20 acres, 15 of which are devoted to alfalfa. The installation consists of a 7.5-horsepower, 220-volt, three-phase motor, running at 1,800 revolutions per minute, belted to a Byron Jackson four-inch centrifugal pump, pumping water from one 10-inch well, 40 feet deep. The total head, including friction is 35 feet and the pump delivers 450 gallons per minute against this head. Seven crops of alfalfa, averaging two tons per acre, are cut per year and one complete irrigation is made for each crop.

The kilowatt-hour consumption per month for 9 months ended December, 1914, was as follows: April, 688; May, 650; June, 1,196; July, 905; August, 1,122; September, 1,088; October, 584; November, 466; December, 88. The average per month was 560 kilowatt-hours and the average consumption per month per horsepower connected 75 kilowatt-hours. The average energy consumption per 1,000 gallons pumped is 0.2 kilowatt-hour.

Another farm in the San Diego district, which may be considered typical, uses a 30-horsepower, three-phase, 220-volt motor, running at 900 revolutions per minute, direct-connected to an eight-inch centrifugal pump delivering 1,500 gallons per minute against a total head of 38 feet, including suction, discharge and friction.

This installation is set in a waterproof concrete pit, 10 feet below the surface of the ground. The water supply consists of 10 10-inch wells varying in depth from 40 to 50 feet. The water level is lowered about 22 feet below the suction level of the pump while pumping.

The kilowatt-hour consumption per month for a period of 11 months is as follows: January, 380; February, 990; March, ——; April, 560; May, 1,400; June, 2,510; July, 2,500; August, 2,290; September, 2,520; October, 1,740; November, 360.

The average energy consumption per

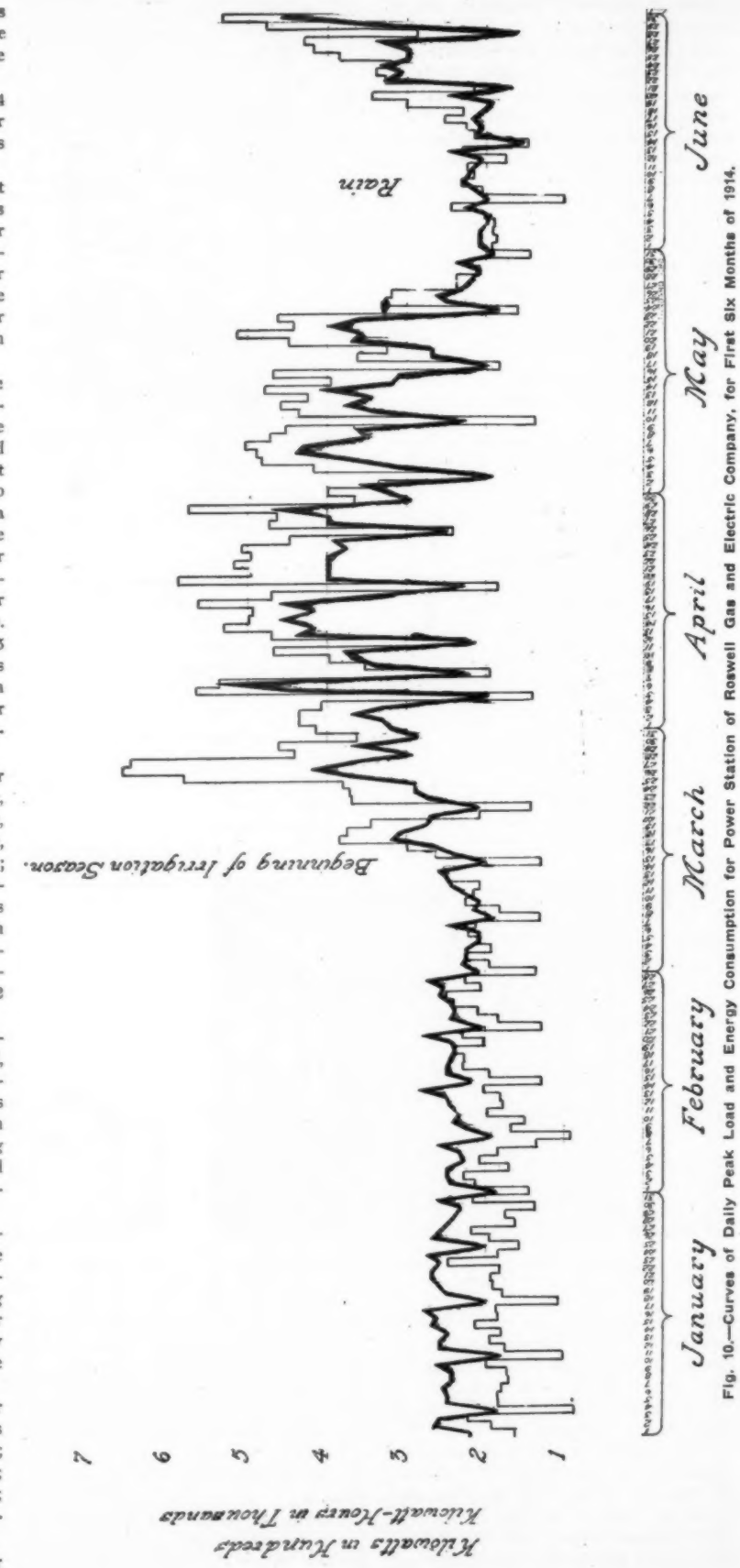



Fig. 10.—Curves of Daily Peak Load and Energy Consumption for Power Station of Roswell Gas and Electric Company, for First Six Months of 1914.

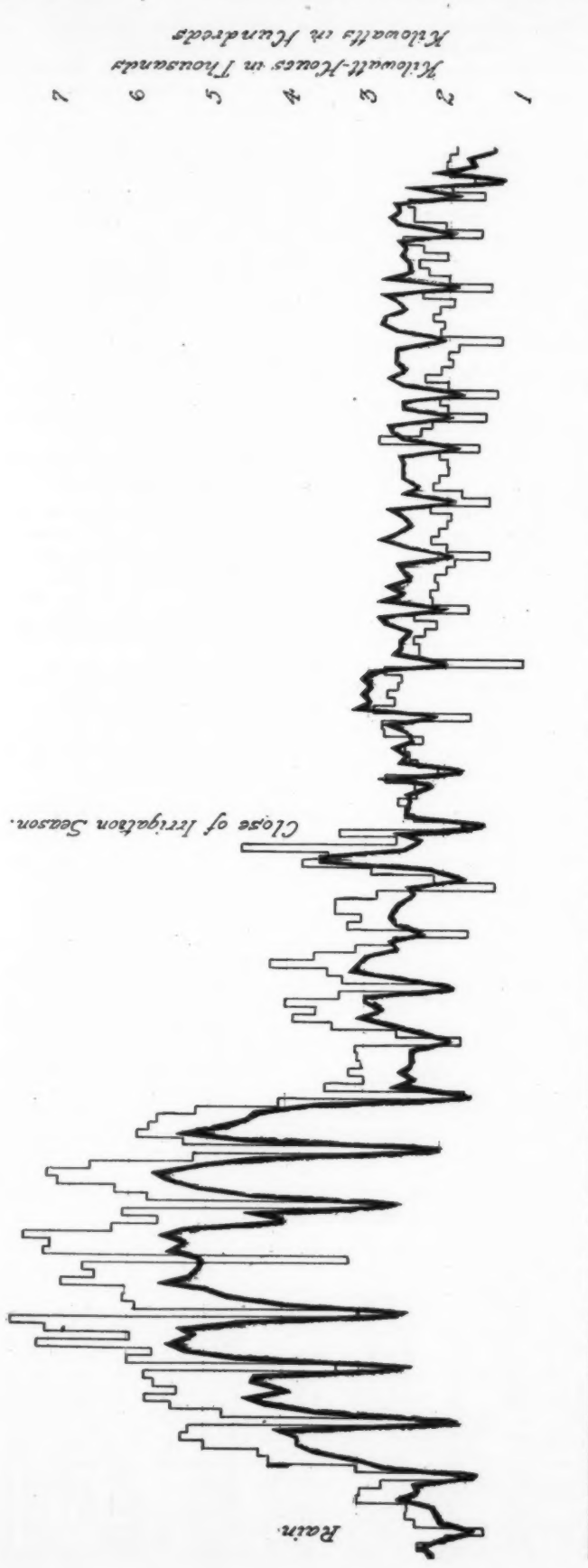



Fig. 11.—Curves of Daily Peak Load and Energy Consumption for Power Station of Roswell Gas & Electric Company, for Last Six Months of 1914.

1,000 gallons of water pumped is 0.2 kilowatt-hour. The load-factor for the year is 9.7 per cent and the maximum demand 18 kilowatts.

The installation irrigates 30 acres of alfalfa and eight crops are cut per year.

In the San Jacquoin Valley conditions are practically the same as in southern California except that the pumps and motors are usually mounted on the surface.

The Western States Gas & Electric Company of Stockton operates 225 miles of transmission line for serving irrigation plants. The company has approximately 740 customers having a total connected load of 6,100 horsepower.

In this district the average consumption per horsepower connected per year is 310 kilowatt-hours. Lines are built into farming communities as rapidly as the business warrants and the average cost per mile of pole line is $1,000.

Water is reached at a level of from 30 to 50 feet and centrifugal pumps driven by squirrel-cage induction motors are used almost exclusively.

While the average size pumping plant is 10 horsepower, there is one installation of 300 horsepower on a 1,100-acre ranch. The pumping load is almost continuous through the months of May to September, inclusive and then gradually diminishes through the winter months. The diversity-factor of the irrigation pumping in the Stockton district is 3.0.

A typical installation in this district is that comprising a 10-horsepower, three-phase, induction motor, direct-connected to a five-inch horizontal centrifugal pump delivering 750 gallons per minute against a total head of 35 feet, including suction, discharge and friction.

The consumption of energy for a period of 12 months is as follows: January, 530; February, 57; March, 162; April, 513; May, 3,367; June, 1,899; July, 1,918; August, 1,687; September, 2,123; October, 980; November, 411; and December, 99. The average kilowatt-hours per month is 1,375 and the consumption per horsepower connected 137.5 kilowatt-hours. The average energy consumption per 1,000 gallons pumped is 0.18 kilowatt-hour and the maximum demand 8.1 kilowatts. The annual load-factor is 19.4 per cent.

This installation is used for irrigating 20 acres of alfalfa. Eight crops are cut each year, with one complete irrigation for each crop.

Several of the illustrations in this article represent installations in the neighborhood of Roswell, N. M., and Figs. 10 and 11 show curves of daily maximum load and daily energy consumption for the Roswell Gas & Electric

Company. Although this central station supplies the town of Roswell with lighting and power, it will be seen that the maximum load is during the irrigation season and not in December, as is the case in most large cities.

Fig. 7 shows a transformer installation. Fig. 1 shows a pump mounted vertically, the motor, pump and equipment being supported by channel beams over the pit. This installation delivers about 1,000 gallons of water per minute.

Fig. 4 shows a pump house complete and arrangement of the discharge before the underground-pipe system of irrigation was installed.

Fig. 2 shows a horizontal pump belted to a 25-horsepower motor pumping out of a river. There are a number of installations like this near Roswell.

### Southern California.

The story of the development of southern California is, to a considerable extent, a recital of what can be accomplished by irrigation.

When the population was small, sufficient water was obtained from rain and melting snows in the mountains during the winter months, to supply the demands of the valleys during the dry summer season.

Land was sold with or without water rights. The land without water was used in dry farming, principally in the raising of grain and hay, while with water it would grow almost any kind of a crop with remarkable results.

As the population increased and the demands for irrigated lands became greater, it was found that the supply of gravity water was insufficient to meet the situation and many of those owning water-bearing land began drilling wells and developing an independent supply of their own. Others who owned gravity water stock found that, in dry seasons, the supply of water was not sufficient, and, as a means of insurance against drouth, also found it necessary to sink wells. As land without water sold for $50 and up per acre, while land which developed water brought several hundred dollars more and, as water development by pumping plants offered more certain supply than gravity flow, many thousands of acres were thus brought under high cultivation that would otherwise have remained dry.

The Southern California Edison Company has been one of the pioneers in promoting the use of electrical energy for irrigation pumping, and A. W. Childs, superintendent of sales, gives the following report of its activities:

In its constant effort to secure pumping business, it has come into active competition with the gasoline engine, especially in fields where plants were in operation before the advent of power lines, and, in many instances, gasoline engines have been taken over as part payment when displacing with motor installations. It now has over 1,500 pumping-plant consumers with a connected load of approximately 45,000 horsepower—an average installation of between 25 and 30 horsepower, with an estimated average annual income per horsepower installed of $18—irrigating in the neighborhood of 130,000 acres. The supplying of water to this amount of dry land has very materially assisted in building up a productive territory to back the growth of southern California cities.

The price of energy for operating pumping plants varies according to the installation. The average rate for a 25-horsepower plant would be 2 cents per kilowatt-hour, with a monthly minimum of $2 for each horsepower of connected load for not less than six consecutive months in each year, the irrigating season usually being from May to October, inclusive—sometimes a month or two longer. For plants of less than 25 horsepower the rate, under ordinary conditions, would be 2.5 to 3.5 cents per kilowatt-hour. Contracts are also taken on a load-factor basis, which makes it possible to earn a very low rate.

In the earlier days of irrigating, there was a certain amount of carelessness in handling the water, inasmuch as a considerable portion was carried in open ditches, with heavy losses in seepage and evaporation. Because of the increasing value of water and the constant desire for greater efficiency in all lines of modern life, the tendency now is to distribute the water in concrete ditches, thus eliminating seepage and in very many cases, distributing the water in entirely inclosed pipes, eliminating evaporation as well as seepage. Fig. 9 shows the buildings on a modern alfalfa ranch with pumping plant in the foreground. Fig. 8 gives an idea of the interior arrangement of the pump house, showing motor and transformers.

Experts say there is sufficient underground water in southern California to irrigate every foot of arid land. New wells are constantly being drilled, and it may safely be predicted that the pumping-plant load will grow to much larger proportions as the growth and development of the state continues.

## Facts and Factors of California Central Stations.

The accompanying table gives figures showing the plant capacity, connected load, maximum demand, energy consumption, investment and income of 11 typical operating companies in the state of California. Other columns in the table show the plant-factor, the annual load-factor, and the relation of investment and income to other elements involved. While complete information is not available for all of the companies under consideration, and while the factors involved are influenced notably in certain cases by the fact that the company purchases part of its power instead of generating it all, these figures will, nevertheless, prove interesting and instructive in showing the large range of the relative values applying to different operating companies.

The relation of the population to the load is so different in cities and in agricultural communities where electric pumping is used for irrigation, that similar ratios with respect to population cannot be expected. Similarly conditions for hydraulic and steam plants are very different with respect to investment and operating expenses.

The average rate at which energy is sold, as indicated by the ratio of gross income to kilowatt-hours generated, has seemed to cover a rather wide range of relative values.

STATISTICS OF CALIFORNIA CENTRAL STATIONS.

| Company. | Is Energy Partly Purchased? | Population Served. | Plant Capacity in Kilowatts. | Connected Load in Kilowatts. | Maximum Demand in Kilowatts. | Kilowatt-Hours Generated (or Purchased). | Kilowatt-Hours Sold. | Ratio of Average Load to Station Rating in Per Cent. | Ratio of Average Load to Maximum Load in Per Cent. | Investment. | Investment Per Kilowatt of Rating. | Investment Per Capita. | Gross Yearly Income. | Annual Operating Expenses. | Gross Income Per Kilowatt of Rating. | Gross Income Per Capita. | Gross Income Per $100 Invested. | Gro. Inc. in Cts., per Kwh. Generated. | Ratio Op. Ex. to Gross Inc. in P. C. | Company. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Yes | 1,200,000 | 172,500 | 360,000 | 124,500 | 658,000,000 | 452,000,000 | .... | 60.6 | $125,000,000 | $725 | $104 | $17,220,504 | $8,913,921 | ... | $14.35 | $13.78 | 2.62 | 52 | 1 |
| 2 | No | 600,000 | 116,050 | 114,674 | 70,565 | 292,545,000 | 233,122,231 | 29.2 | 47.4 | 48,829,560 | 421 | 81 | 2,825,253 | 1,027,598 | $24 | 4.71 | 5.85 | 0.97 | 36 | 2 |
| 3 | No | 535,000 | 23,552 | 53,140 | 12,740 | 34,444,000 | 27,376,190 | 16.9 | 32.2 | 5,685,680 | 242 | 11 | 1,501,041 | ..... | 64 | 2.80 | 26.40 | 4.35 | .. | 3 |
| 4 | No | 248,000 | 42,780 | 44,407 | 19,300 | 107,922,000 | 80,006,149 | 29.2 | 63.8 | 10,485,184 | 245 | 42 | 1,554,448 | 523,440 | 36 | 6.27 | 14.83 | 1.44 | 34 | 4 |
| 5 | Yes | 95,000 | 13,760 | 33,000 | 7,500 | 21,000,000 | 16,000,000 | .... | 32.0 | 5,250,000 | 382 | 55 | 747,748 | 333,333 | ... | 7.87 | 14.27 | 3.56 | 44 | 5 |
| 6 | No | ..... | 14,550 | 21,967 | 8,140 | 27,907,591 | 25,170,492 | 22.2 | 39.2 | 3,500,000 | 241 | ... | 640,000 | 480,000 | 44 | .... | 18.30 | 2.30 | 75 | 6 |
| 7 | No | 50,000 | 15,100 | 16,200 | 9,255 | 45,687,700 | ..... | 35.1 | 56.3 | 5,662,910 | 375 | 113 | 674,676 | 315,615 | 47 | 13.49 | 11.88 | 1.44 | 47 | 7 |
| 8 | Yes | 48,000 | 5,250 | 21,800 | 7,175 | 40,855,000 | 33,143,645 | .... | 62.9 | ..... | ... | ... | 1,117,867 | 594,038 | .. | 23.25 | .... | 2.74 | 53 | 8 |
| 9 | No | 38,275 | 11,250 | 11,922 | 7,150 | 33,250,000 | ..... | 34.2 | 53.1 | ..... | ... | ... | 385,331 | 159,478 | 34 | 10.07 | .... | 1.16 | 41 | 9 |
| 10 | No | 15,000 | 4,500 | 5,800 | 1,500 | 5,297,600 | 3,772,000 | 13.6 | 40.9 | ..... | ... | ... | 186,396 | 95,839 | 41 | 10.36 | .... | 3.52 | 51 | 10 |
| 11 | Yes | 10,000 | 4,000 | 8,239 | ..... | ..... | 14,476,560 | .... | .... | 16,670,594 | ... | 1667 | 296,518 | 114,845 | .. | 29.65 | 1.78 | 2.05 | 39 | 11 |

# Accident Prevention on a Business Basis.

**The importance of accident-prevention work among public utilities from a monetary as well as humanitarian standpoint has, in the case of one important group of utilities, led to the establishment of a separate bureau to scientifically apply the principles of safety work. The activities of this organization are described in this article.**

The man on the job is the most important factor in accident-prevention work, and the guarding of machinery is of secondary importance. This is the underlying principle in all work carried on to reduce the appalling number of accidents occurring daily in our large industrial institutions and those who have achieved the greatest success in the conservation of human life and limb are those who have given the greatest consideration to this element.

Too much importance cannot be placed upon the work of educating the employee — making him understand that accident-prevention work is for him and can be successfully carried on only by his hearty co-operation. He must realize that his ability to earn a living is his only asset and that he becomes a bankrupt when he loses it. He must learn to zealously conserve this ability by constant and never-ceasing care.

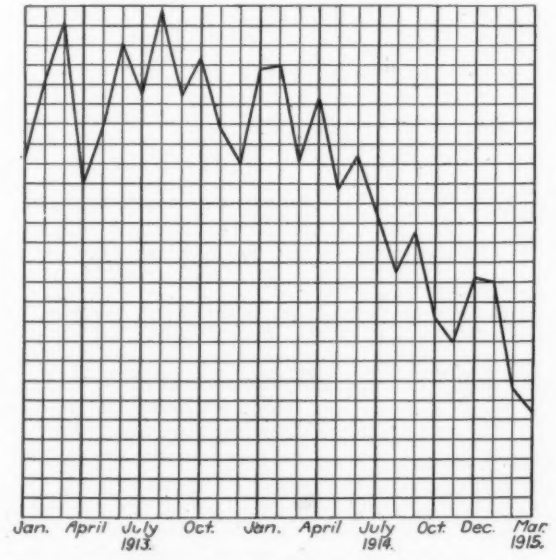
An organization thoroughly alert to this thought will make a better record for safe operation than the most expensively equipped plant whose employees are without this conviction. Safety workers are not giving enough attention to implanting this spirit of accident prevention in the organizations and in some cases are "running away with themselves" inspired by ideas of inspection and ofttimes expensive installation and reconstruction.

The recent publicity which has been given safety work has been responsible for a greater conservation of life and limb than all the mechanical safeguards that are to be provided in the next decade, for it has produced the prevention spirit where it did not exist; it has caused men to think where they once acted automatically; it has caused men to realize that the safety movement is for them and by them; it has taught them that "personal caution is the greatest safeguard after all."

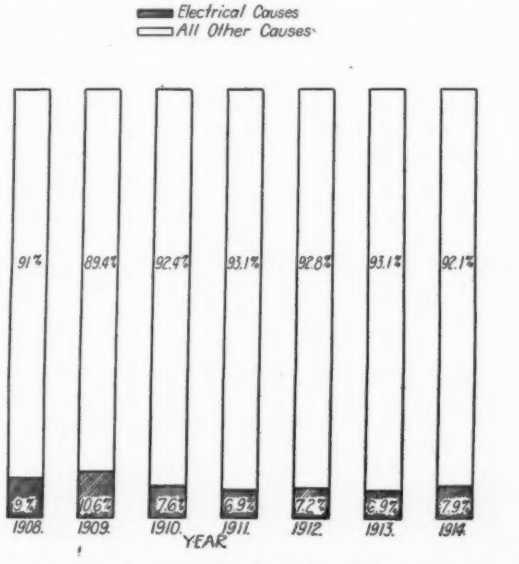
The importance of safety work to the public utility company is only partially appreciated by central-station executives. In an address delivered recently before the National Council for Industrial Safety, Martin J. Insull, of the Middle West Utilities Company, commented upon the desirable results accruing from active participation in accident-prevention work on the part of utilities and his remarks which are subjoined should serve to emphasize the necessity for a study of this question.

A public service corporation, to be successful, must necessarily have for its field of operation, one or more progressive communities. On the other hand, no community can progress to any considerable extent unless it is adequately supplied with the different classes of service furnished by the various public service corporations. The appreciation of both during the past few years of this interdependence on each other has, undoubtedly, led to the marked improvement in their relations. The successful public service executive of today is a man of broad vision. He is in touch with the best civic requirements of the communities he serves and is ever ready to help toward that development, which is equally as necessary for their success as for that of the corporation which he represents. It is unusual not to find his company amongst the leaders in any movement—industrial or social—organized for the betterment of present conditions. And so, year by year, the public service corporations and the public have been drawn closer and closer together by ties of mutual interest, having for their final object, their individual and mutual advancement.

Unfortunately, however, the continued progress toward this much desired end is retarded by a condition which has increased rather than decreased during the last decade. We are all familiar with that questionable class of personal injury suit, without real merit, and in which the damages sought are magnified in every way by all parties in interest. As a matter of course, these cases of really manufactured injury, for which money is the sole and immediate remedy, have no relation to




Plat Showing Decrease in Disability Cases per Hundred Employees During Safety Campaign.

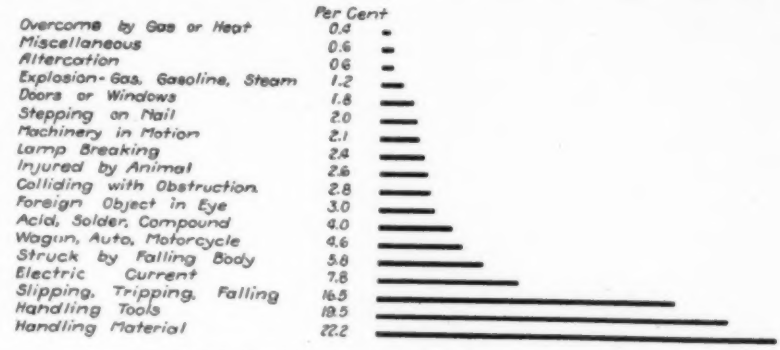



Accidents to Employees Analyzed as to Electrical and Other Causes.

those unfortunate and meritorious accidents in which the injury is real. Overcoming this wretched condition, or diminishing it, will help materially in furthering more and more pleasant relations between the public and the public service corporations.

The safety movement, by eliminating the possible causes of accidents, by the education of employees to prevent, and of the public to avoid accidents, must result in, at least, retarding the growth of this evil. A better understanding by the general public of the efforts of public service corporations for the safety of their life and limb, would have a great moral effect in helping to stamp out, both in their inception as well as at their disposition before a jury, these unreasonable claims which are, at the best, based only on a shadow of facts. This would not only be of benefit to the corporation, but also to that large proportion of the honest public, whose only accident claims are those made when real injuries are suffered.

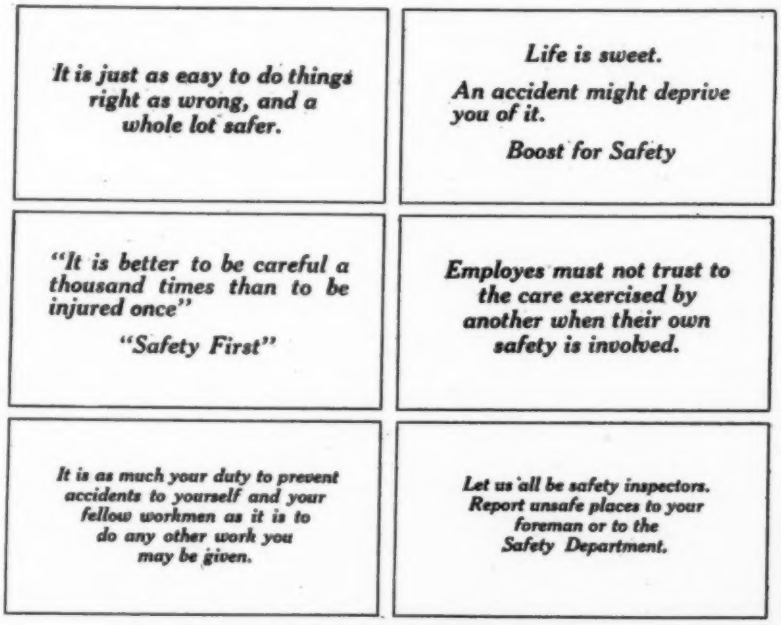
The public, as a whole, do not seem as interested or as helpful as they should be in the efforts taken by corporations for their safety. If anything, they resent them as an infringement of their personal rights, rather than welcome them as a protection for their life and limb. Many a time we have seen the passenger on a street car objecting to the efforts of a careful conductor to prevent him or her from taking the chance of being injured by leaving the car before it stops, or by stepping down in front of a passing vehicle. This practice of getting on or off moving cars was the cause of such a large percentage of street-car accidents that in order to protect the public against their own carelessness, it became necessary to construct cars with doors and steps so controlled by the motorman or conductor as to make it impossible to board or alight therefrom while the car was in motion. It is an everyday occurrence to see people walking across railroad tracks in front of an approaching or standing train, around lowered gates, provided by the railroad company for our protection. The number of people killed as a result of trespassing on railroad rights of way placarded as dangerous and properly fenced in, have been so numerous that, in some states, it has been made a misdemeanor, punishable by fine and imprisonment. Notwithstanding all that has been said and written about the dangers of touching fallen wires, we, quite frequently, read of people being electrocuted as a result of so doing. Rules and regulations, made by the public service corporations for the protection of the public, and for that of their employees, are, in spite of close supervision, constantly broken with a resulting list of accident reports daily coming in to the safety or claim department. The extravagant disregard for the value of their safety is shown every day by the public on city streets and in public places. During the automobile season




Accidents to Employees Analyzed as to Causes.

the papers are constantly reporting terrible accidents, invariably caused by suicidal carelessness. And so we might go on *ad infinitum*, recounting preventable accidents for which the public itself is entirely responsible. It is, therefore, essential that from a humanitarian as well as an economic point of view, the public service corporations should deeply interest themselves, as they are doing, in the great safety movement that has in a remarkably short space of time spread itself all over this country. To avoid the unjust claimant from taking advantage of them, and to protect the honest public against its own carelessness, they cannot afford, within the limits of good business judgment, to leave anything undone that will add to the safety of their service, their patrons, and their employees. They cannot develop any well defined safety movement amongst their employees and secure their interest without it being reflected in a more considerate and courteous treatment of their patrons. This, with the reputation of safe service, which the safety movement must eventually develop, will, through the number of friends it gains for the corporation, tend to further improve its relations with the public.

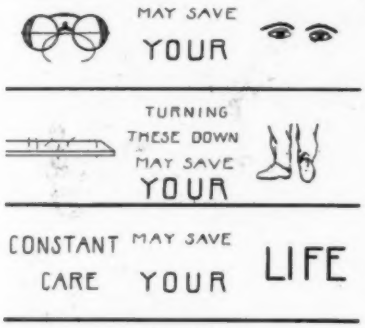
How can this safe service be secured? Certainly, the use of well tried safety devices for the protection of employees and patrons is necessary, as well as the enforcement of proper safety rules and regulations. These, alone, however, judging from the few instances mentioned and the experience of public service officials, as well


It is just as easy to do things right as wrong, and a whole lot safer.
Life is sweet.
An accident might deprive you of it.
Boost for Safety
"It is better to be careful a thousand times than to be injured once"
"Safety First"
Employes must not trust to the care exercised by another when their own safety is involved.
It is as much your duty to prevent accidents to yourself and your fellow workmen as it is to do any other work you may be given.
Let us all be safety inspectors. Report unsafe places to your foreman or to the Safety Department.

Samples of Slips Placed in Pay Envelopes of Employees.

as executives in other branches of industry, who have studied accident prevention, will not insure safety. What is needed above all else is the co-operation of the individual whose safety you are endeavoring to conserve. This can be obtained only by education along safety lines. The education of the employees is comparatively simple when once you have aroused their interest. Experience proves that this is not a difficult task, as, in every man, there lies dormant, not only the spirit of self-preservation, but also the more unselfish and higher spirit of the preservation of his fellows. The more difficult problem is the education of the public in accident prevention, in general, so that they will appreciate that the safety rules of any service or industry are solely for their protection and not with any idea of restricting their personal rights.

There is nothing mysterious in the safety movement; it is a simple, com-




**Sample of Posters.**

mon-sense proposition dealing with a particular form of conservation of the human body, based on humanitarian as well as economic motives. The more thought and study one gives to accident prevention, the more one is impressed with its simplicity and the necessity of education along purely general common-sense lines so that each individual will learn to use the necessary precautions in preventing accidents to his or her own body, and to that of others. Education along the lines of general accident prevention should start in the kindergarten and be carried through the high school and the college.

There is good reason that a plea for accident prevention along general lines should be made, because until this is accomplished, how can the public service corporations, or the industries, expect accident prevention along special lines? While we, in our particular lines of industry, are endeavoring to educate the public in the prevention of accidents incident to that industry, we must assist, in every way we can, in their education along the more general lines of accident prevention. The public service corporations can, through their close contact with the public, do a great deal in this campaign of education. It will take some time for the public to appreciate that the work is being carried on for their benefit, but when they do, they will be ready and willing to assist in any way they can. Working together, the public and the public service corporations in a safety movement for the common good will come to a closer, and, if possible, a more friendly relationship than even exists today.

Perhaps the most comprehensive effort extended to reduce accidents among public utility companies is that of the Bureau of Safety of Chicago, an independent organization, operated solely in the cause of accident prevention.

The Bureau of Safety was organized January 20, 1913, and its primary purpose of organization was to carry on safety and welfare work in the Middle West Utilities Company's properties. These properties consist of electric light and power plants, gas works, water plants, ice plants and interurban and street railways located in the West, Middle West and in some of the New England States. Later, the service of the Bureau was extended to the Commonwealth Edison Company of Chicago and the Public Service Company of Northern Illinois. These three companies are usually known as the Insull group. In the application for incorporation filed with the Secretary of State of Illinois, the objects of the Bureau are stated as follows:

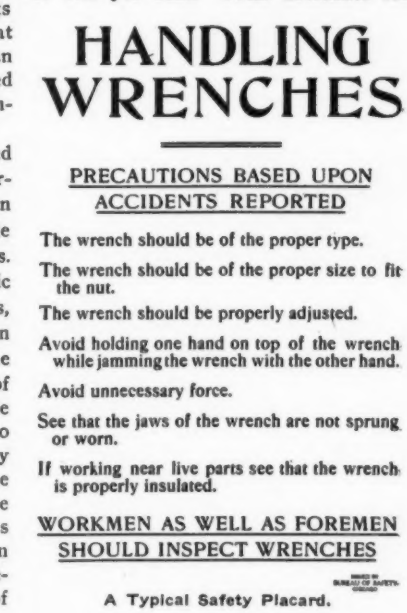
(a) To conserve human life and to prevent needless physical and mental suffering by reducing the number of avoidable accidents; to prevent needless loss of property by reducing the number of preventable accidents and preventable fires.

(b) To study conditions, customs and practices that are a menace to industrial or public safety, and to make remedial suggestions.

(c) To organize officials and employees in proper groups to the end that the personal effort and interest of each individual may be secured for accident and fire prevention.

(d) To inaugurate and carry on education work in accident and fire prevention among all classes of employees and with the public; to bring about a better understanding and a more enlightened and constructive co-operation between empolyers and employees and between public service corporations and the public; to make inspections and recommendations for the elimination of industrial accidents and for reducing fire casualties; to furnish such statistical and other data as will contribute to an intelligent study of accident and fire prevention, industrial sanitation and welfare work; and, in general, to supervise and direct activities in accident and fire prevention, industrial and sanitation and welfare work, and to counsel in reference to such work.

The success which the Bureau has achieved is convincingly demonstrated by its record showing that accidents involving loss of time in all companies served, for the first four months of 1915, as compared with the same period of 1914, and taking into consideration the number of employees, show a decrease of 47.8 per cent. Fatal accidents for this same period, both to public and employee, show that in 1915 there were none as compared with 11 for 1914. The education of the employee and securing his interest and co-operation, is held almost entirely responsible for this creditable record.


HANDLING WRENCHES
PRECAUTIONS BASED UPON ACCIDENTS REPORTED
The wrench should be of the proper type.
The wrench should be of the proper size to fit the nut.
The wrench should be properly adjusted.
Avoid holding one hand on top of the wrench while jamming the wrench with the other hand.
Avoid unnecessary force.
See that the jaws of the wrench are not sprung or worn.
If working near live parts see that the wrench is properly insulated.
WORKMEN AS WELL AS FOREMEN SHOULD INSPECT WRENCHES

**A Typical Safety Placard.**

The Bureau of Safety is in charge of Charles B. Scott, general manager, assisted by Alexander Shane, Samuel H. Ried and a corps of competent assistants. Mr. Scott's first experience in safety work was in connection with the Louisville & Southern Indiana Traction Company and the Louisville & Northern Railway & Lighting Company, New Albany, Ind., and began about January, 1907. The accidents on these properties have been reduced more than 80 per cent since that time and this percentage has been maintained for several years. This reduction includes accidents to employees and to the public and was due to the co-operation of the trainmen and other employees of these companies. These

companies give city and interurban service, crossing the Ohio River and through the streets of Louisville, Ky. Accidents were very frequent on these roads eight years ago and the idea prevailed with the trainmen that they were unavoidable and a part of the electric railway business. There has been a change of opinion with officers and employees. The companies have secured the co-operation of the public through efforts to promote general safety and this public co-operation has been most beneficial. This co-operation was obtained mainly by public lectures, the use of the public press and work in the schools.

In the education of the employee the main activity of the Bureau is to first secure his interest and co-operation. It has been found that this can best be accomplished by the establishment of clubs, committees, etc., with the employees in absolute charge. Lecturers are sent out by the Bureau to address the meetings of employees and occasionally employees are encouraged to present papers on various phases of safety work. Workmen who show but little interest in the effeorts of their employers to increase their safety usually become enthusiastic advocates of accident-prevention work when given the responsibility of an office or committee appointment in an employees' organization.

Bulletins written in a manner to appeal to the employee are published at periodic intervals and sent to every employee in the companies served. There is usually a leading article dealing with some phase of safety work and illustrations showing the proper and improper manner of performing some work about a power plant, transmission line, etc. The feature of the bulletin which is of most importance is the record of "Typical Accidents Which Might Have Been Avoided." In this department typical accidents which have actually occurred are analyzed and the reason for the accident pointed out with instructions as to the proper manner of performing the work.

In addition to this, placards, posters and other advertising matter and literature are sent to all companies to be posted on bulletin boards in stations, shops, etc. The Bureau makes a scientific analysis of all accidents and from these statistics can ascertain in just what direction the greatest precaution should be taken. Samples of such analyses are shown graphically in the accompanying illustrations on pages 1029 and 1030.

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The new electrically operated double-track swing railroad bridge over the Lachine Canal at Montreal is said by Canadian papers to be the most up-to-date in America.

## ILLUMINATION FEATURES AT PANAMA-PACIFIC INTERNATIONAL EXPOSITION.

By Arthur A. Willoughby.

An iridescent bubble glistening in the midst of a sea of softened light, flashing in colors of an opalescent hue, fretted patterns of bars, rings and spots of colored light climbing out of the horizon, crossing paths and following each other in a bewildering procession over the surface of a vast dome, then fading mysteriously away, a never ending delight to the onlooker who is gazing on the newest of wonders in illuminative art, the glass dome of the Palace of Horticulture, the largest in the world, at the Panama-Pacific International Exposition will furnish in an ever changing series of spectral color achievements, one of the grandest, most spectacular night-time lighting effects ever conceived in the mind of man.

Avenue of Palms, with Italian Towers and Tower of Jewels Illuminated.

Such new, such startling effects in shapes and colors are unbelievable until a person has actually seen them. The entire lighting scheme of the Exposition, fathered by one man and by him created in his laboratories, has proven one of the wonders of a wonderful Exposition in shaping the trend of illuminative practice in the future. The preternatural effects to be gained by the use of high-powered searchlights casting their beams upward through colored revolving screens and lenses of various types to the dome, is beyond the power of expression. Moreover it is the first public demonstration of what can be accomplished in dome lighting for spectacular effects.

W. D'A. Ryan, in his efforts to produce a unique and effective system of illumination, met with a great deal of skepticism. The entire lighting plan is radical, different from anything previously attempted. His faith in the plan was unbounded from the beginning. The lighting of the large dome probably represents more intricate reasoning than any other form of illumination ever mathematically worked out. While it is but one unit of a comprehensive scheme for the entertainment and enlightenment of visitors to the Exposition, it strikes the keynote of the whole plan.

Many effects are possible in the dome lighting by the use of five sets of specially designed lens plates, in various combinations, and by the use of opaque sectors which cut off some and which permit some light from the searchlights to reach the screens where the beams are colored and projected upward. Three color arrangements are always possible, a constant color appearing as a general diffusion over the entire dome, a spectral series, and an enlarged spot, mottled with rotating colors. One of the most beautiful effects is seen in a series of twelve ribbons of light, each a sixth of a revolution ahead of its neighbor, all turning together. The united action appears, as a rippling wave of light traveling around the dome. The color arrangements in this case appear as a constant color for each ribbon, then the spectral series, in which the whole ribbon assumes various solid colors, then a rainbow effect, each ribbon having one edge of red and the other of

Entrance to Palace of Horticulture.

Palaces of Agriculture and Transportation.

blue with various intermediate colors. Each ribbon appears twice as a rainbow during a rotation and twice as a solid color. Added to the ribbon effect are seen rising out of the horizon, planetary rings of light together with spots, appearing in the various color arrangements. Some are seen remaining stationary while the others revolve about them in various orbits. It is purely an astronomical effect and one which baffles powers of adequate description. Twenty various combinations have been worked out and all have proven marvelous conceptions. The possible combinations are infinite.

The various spectacular lighting units of the Exposition are the dome of the Palace of Horticulture, the wonderful Tower of Jewels and the scintillator of 48 searchlights placed on the waterfront. Coupled with this is an elaborate scheme of flood lighting for the facades of the exhibit palaces, a moonlight effect for the Palace of Fine Arts, lighting for the various courts, avenues and streets and the amusement concession district. The system used in lighting the interior of Festival Hall is a separate and distinct type of interior lighting which is unique.

The Tower of Jewels at Night.

Entrance to the Court of Palms.

The Tower of Jewels under the concentrated glow from 50 searchlights, has proven an even more wonderful picture of light than any except its designers have prophesied for it. Rising to a height of 435 feet and towering majestically above the surrounding buildings, studded with many thousands of Novagems hung so as to swing with the slightest movement of the air, it presents at night one of the most vivid pictures of quivering, sparkling light ever produced. The interior of the large ball surmounting the tower and the colonnades about the various terraces, appear in relief in a blood-orange glow as a background for the myriad twinkling of the jewels. Such doors are used on the searchlights as will direct their rays on the tower without any waste light and without revealing the sources of illumination. The hanging of the jewels was completed considerably in advance of the opening date and this gave time for making thorough tests.

The tower rises in eight receding stages, each stage except two being

surrounded by a colonnade and being ornamented with various sculptured effects. These furnish the motif for the entire jewel scheme. The jewels have been hung in strips and arranged in elaborate designs over the surface of the tower and the statuary to coordinate with the architectural plan. Each Novagem has a tiny mirror placed behind it to catch the rays of light and direct them through the facets, giving an indescribably beautiful effect of glittering, sparkling colors of every hue of the rainbow. The least atmospheric change causes them to swing as a pendulum and it is this swinging that causes the various changes of color.

The soft flood of light cast on the entire south front of the exhibit palaces, a half mile in length, with the tower in the center of the picture and the two Italian towers flanking the court to either side with their domes standing out in bold relief in blood-orange light, is at once a scene of ravishing beauty. The relief lighting also appears in the courts. The dome of the Palace of Horticulture appearing in the western portion of this picture adds a distinctive touch to the color scheme.

The lighting of Festival Hall makes a new departure in the lighting of the interior of large auditoriums. In a pit beneath the center of the floor are placed twelve searchlights which are set to throw their beams upward into a diffusing disk of thick glass sandblasted on the under side, which distributes the light over the dome covering the auditorium, the dome acting as a reflector. The illumination thus secured is effective in every particular and a noteworthy advance in interior lighting.

Nothing of a garish nature has been permitted in the lighting scheme except in the concession district, where it is the natural accompaniment of the fun and frolic reigning there. The facades of the exhibit palaces are lighted up by high-power arc lamps, set on lofty standards and having heraldic banners hung on the outer front and to either side so as to throw the rays on the buildings which by reflection light indirectly the surrounding roads and walks. Ornamental incandescent standards are also used along the Avenue of Palms, interspersed among the foliage. In the South Gardens, numerous ornamental standards bearing clusters of lights in diffusing globes, are used.

In the grand Court of Honor, two lofty fluted columns of glass stand at either extremity of the sunken gardens. These are equipped with high-power nitrogen lamps and by the use of heavy, diffusing glass, a wonderfully clear yet subdued light is obtained and gives a beauteous effect.

The Palace of Fine Arts, which has a picturesque setting, is flooded in a moonlight glow by the skillful use of softened, bluish light, and mirrors its beauties in the placid waters of the foliage-fringed lagoon, which makes an attractive frontispiece. The feeling of absolute quiet has been striven after and has been achieved.

The humidity of San Francisco atmosphere and the fogs which drift in through the Golden Gate close by aid materially in the spectacular displays by the scintillator. A dry, clear atmosphere detracts from the effectiveness of the displays. Smoke bombs bursting high in the air, the smoke and steam from a locomotive stationed nearby, are used for playing up marvelous color effects on clear nights. The 48 searchlights, the largest of their kind, each equipped with six color screens, can be used to furnish one great burst of light or 48 separate beams at the will of the operators. It requires a trained force of 60 men to operate the scintillator.

Sculpture by Calder over the Fountain of Energy.

The scintillator effects take the place of fireworks entirely, eliminating thereby all danger from accidents to spectators and of liability of fire. A regular program has been arranged for each evening of the Exposition period.

A gala effect is gained in the concession district by the use of streamers of colored incandescent bulbs in various shapes, sizes and colors, swinging to and fro in the breeze, hung from pillar to post in every direction. Outline lighting on the fronts of the buildings in this district has been permitted under certain restrictions. Ornamental gas standards fantastically decorated and hung with Oriental lanterns, line both sides of the street its entire length. A garish blaze of light is usually expected to be seen where joy is king. It is found here, but in such color and shaded enough as not to be tiring to the eye. It makes a new chapter in amusement-park lighting.

Fully 450 searchlights have been installed about the grounds, mostly in batteries on the roofs of the main exhibit palaces. Fifty alone are used for the Tower of Jewels. Four batteries are trained on the Palace of Fine Arts. A number are used for lighting up the various flag standards. Others are used in the Court of Honor for playing up the Novagems on the star figures which adorn the balustrades about the court.

The main intent of the lighting scheme has been to preserve to the sightseer all of the architectural beauties so evident in the daytime, in a beautiful nighttime setting and to lose none of the exquisite coloring of the buildings. A festive and happy effect throughout the exhibit palace section, which is to be closed to the public at night, is gained through the use of reflected lighting units suspended behind the arches over the entrances and behind the clerestory windows of the various exhibit palaces and which give the appearance of the building interiors being fully lighted up. The various statuary groups which adorn the grounds and buildings have all been given special attention, a new feature in lighting methods. A strong beam of light is thrown on the statuary and a weaker colored beam from another direction gives a luminous shadow and serves to throw out the statuary in bold relief.

In the Palace of Horticulture, the suspended fixtures are of lattice work with floral decorations to carry out a flower-garden effect. In the areaways back of the colonnades about the courts, large ornamental lanterns with panels of colored, translucent fabrics are used and heighten the effect of the relief lighting in the upper galleries.

It has been tireless effort on the part of Mr. Ryan and his assistant, A. F. Dickerson, to plan and carry out such a comprehensive scheme on such a vast scale and have it check up without a detail omitted, but the marvelous results obtained will make the Panama-Pacific International Exposition unique among expositions and will abundantly repay their efforts.

## The St. Lawrence Basin.

The St. Lawrence River system is international, and new questions arise almost every year with respect to the proper division of authority over and the use of this great source of water supply. An important report, recently issued by the United States Geological Survey, entitled "Surface Water Supply of St. Lawrence River Basin, 1913," by C. C. Covert and W. G. Hoyt, contains results of stream-flow measurements made in the St. Lawrence River basin during the year 1913. The report includes measurements on rivers emptying into the St. Lawrence by way of Lake Champlain and the Richelieu.

# The New Commonwealth Edison Building.

A glowing tribute to the growth of the central-station business of Chicago is the fact that the Commonwealth Edison Company has found it necessary to occupy one of the largest office buildings in this city. The new Edison building, located at the northeast corner of Clark and Adams Streets, was formerly the home of the Continental and Commercial National Bank, and, for several years, was known as the largest office building in this city. Even today it is exceeded in size by but two recently completed structures.

The Commonwealth Edison Company does not at the present time use the entire 385,000 square feet of floor space available in the new building, but fully 68 per cent of this amount will be occupied when the allied companies move to their new quarters, and if the growth of the company in the next few years to come is commensurate with its growth in the past, it will not be long before this entire great structure is devoted exclusively to public utility offices.

Before moving to the new buildings, considerable remodeling had to be done in order to provide for the departments with which the public comes in contact spacious and accessible quarters. The bank floor, reached by a wide staircase from the ground floor, was admirably suited for use by the treasury department, although many changes were made in the arrangement of cashiers' cages and counters. The space on this floor aggregates 31,500 square feet and is used by the treasury department, a suite of offices of the claim department and the division of the contract department which takes applications for service.

The arcade on the main floor, comprising 11,000 square feet, is being converted into an exhibition and sales room. Here will be displayed practically all of the many devices and appliances suitable for use in the home, office and factory, and special rooms will be equipped for displaying lamps and fixtures for both residential and commercial use. For displaying residential fixtures, a room will be equipped with modern dining room furniture and decorations, and the ceiling will be provided with a bank of outlets so that lamps and fixtures can be readily changed. Likewise a room will be equipped with the usual store fixtures and show cases to demonstrate the efficiency and effect of the various types and styles of commercial lighting equipment. The entrances to the building on both Clark and Adams Streets, which are also the entrances to the display room, will be entirely remodeled so as to form approaches to the display rooms, and at the same time provide considerably more window space for display cases.

The contract department, occupying 18,300 square feet, is located on the third floor. The auditing department occupies a like amount of space on the fourth floor. The operating department is on the fifth floor, and engineering and construction departments on the sixth floor. Various other departments are on the floors above, with the executive offices occupying the entire seventeenth floor.

The welfare work of the company has received special consideration and space will be reserved on the eighteenth floor to accommodate each feature as it is developed. Among other things it is contemplated that provision will be made for a dining room with a seating capacity of 1,000, with suitable kitchen facilities; smoking room, library and assembly room, the latter with stage settings and facilities for motion picture and stereopticon entertainments.

The attic on the nineteenth floor contains various service departments, such as carpenter shop, building repair shop and here is also located the photographic department with skylight and other modern facilities.

It is planned at present to convert the roof into an open-air garden and gymnasium for the use of employees. Tennis and hand-ball courts are contemplated as well as a glass-inclosed gymnasium.

The building was originally provided with its own isolated generating plant and of course the first move of the Edison Company was to remove this and arrange for central-station service. Hydraulic elevators, of which there were 14 passenger and one freight, were also removed and electric elevators of the Otis traction type installed. The latter now run on schedules timed by an electric timing device which lights pilot lamps at the top and ground floors, which signal the operators when to start their cars.

The entire building is equipped with a time clock system operated from a master clock and all offices are provided with secondary clocks. Battery service for buzzers and intercommunicating telephone systems is also provided in all offices. In this connection it might be stated that in all large departments of the Commonwealth Edison Company intercommunicating telephones are employed. Outside telephone service is supplied through what is considered the largest private-branch exchange in the world. A 20 position switchboard is installed in the Edison Company exchange and provision is made for 10 additional positions. There are 82 trunk lines and 620 local lines served by six 600-pair cables. There is also a private system connecting the load dispatcher's office with the various stations. This line was built and is maintained by the Chicago Telephone

The New Building of the Commonwealth Edison Company, Chicago, Ill.

Company but is a direct and private line.

### Lighting Features.

The interior lighting of the new Edison Building is one of its most important features. The illuminating engineers of the company, after much investigation and many tests, decided on an amber-tone light as best suited for office purposes, and in all lighting installations equipment was installed to produce this quality of light. It was necessary therefore to specify special glassware and all bowls and reflectors used in the building are made of this glass which is known as Calsite, and which has a highly efficient reflecting surface. Direct, indirect and semi-indirect lighting is used, with the latter predominating. The bowls of both the indirect and semi-indirect are installed in special holders, hinged at one side so that they can be easily lowered for cleaning either bowl or the lamp. Bowls are also interchangeable so that an indirect or semi-indirect system can be changed, entailing a minimum amount of work and expense.

In designing the lighting installations it was the aim of the engineers to entirely eliminate the necessity for the use of individual desk or table lamps. To do this successfully it was found that the usual intensities of 2.5 to three foot-candles were not sufficient. All installations, therefore, were made on the basis of an intensity of four foot-candles, allowing to some extent for the aging of the lamps. The typical installations throughout the building are made on the basis of 1.5 watts per square foot, except in the drafting department, where 2.5 watts per square foot are installed.

In considering the lighting installation, proper consideration was given to the matter of interior decorations and a standard scheme was adopted, providing a white ceiling, yellow tinted walls from the picture moulding to the chair rail, and light brown below this.

Outlets of sufficient size to take a 300-watt lamp are installed in all cases. The maximum space between outlets in all cases is 14 feet and the minimum spacing 10 feet. Lamps used throughout the building are usually of the 60 or 100-watt sizes. Circuits are all of 600-watts capacity and are arranged parallel with the windows on both the Adams and Clark Streets sides.

The lighting of the second floor occupied by the treasury department presented a most complex problem and was finally solved in a rather unique manner. Over the center of the floor is a sky-light parallel with the floor, 90 by 50 feet, with glass hip roof. It was planned to light this sky-light artificially throughout the entire day and the result is that the intensity never varies regardless of whether it is a bright or cloudy day or whether it is daylight or night. Parallel rows of 60-watt, 100-watt and 150-watt lamps, spaced three feet apart and hung from messenger cable at varying heights from the base of the sky-light are used to produce the effect noted. There are four rows of 60-watt lamps, four rows of 100-watt lamps and two rows of 150-watt lamps, the latter being hung in the apex of the triangular roof. This lighting is supplemented with 50 two-light bronze bracket fixtures and six single-light fixtures all of the semi-indirect type and equipped with 500-watt lamps. The cashiers' cages on this floor and the open counter where contracts are signed, are lighted by means of lamps

Main Entrance, Treasury Department.

Contract Department, Showing Typical Interior Illumination.

A Department Manager's Office.

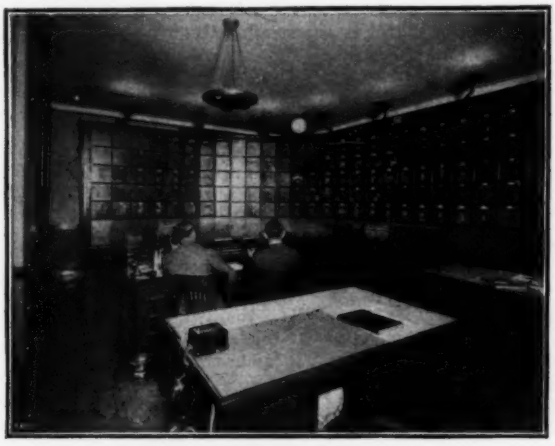
In the Accounting Department.

placed in a specially designed trough covered with ground glass.

The lighting of the contract department on the third floor is typical of the general lighting throughout the various offices. The ceiling in this room is 15 feet, four inches high, and the fixtures are equipped with three 60-watt lamps spaced approximately 10 feet apart. A view of this department showing the type of units employed is shown in one of the accompanying illustrations. Bowls in this case are 16 inches in diameter, this size predominating throughout the building. There are also some 14-inch bowls and some 20-inch bowls, the latter using four lamps.

While no definite plans have been made as to the type of exterior lighting ultimately to be employed, the company has been carrying on a number of experiments, the main idea being to arrive at a lighting installation which will properly bring out the architectural features of the building and be of advertising value as well as unique and dignified. In one case ten 1,000-watt nitrogen-filled lamps were suspended from the cornices at the top of the building. These lamps were spaced 10 feet apart and were equipped with special white enameled steel reflectors arranged to direct the rays of light down the sides of the building. Later this installation was increased to 20 lamps, some being equipped with a special projector and installed 16 feet from the building. Flood lighting of the building was also tried, installation of special projectors being located on the Lakeside Building diagonally opposite. An installation of ornamental posts, equipped with high-efficiency lamps was also made on the window ledges of the second floor. It is not known whether or not any future experiments will develop any more suitable or effective lighting than has already been obtained, but the decision as to the system to be adopted will be withheld until more experiments have been made.

In the Load Dispatcher's Department.



The Load Dispatcher's Office.

A Cage in Cashier's Office, Showing Special Illumination.

In One of the Drafting Rooms.

## Panama Canal Radio Stations Nearly Completed.

Construction work on the new Naval radio stations at Darien, Balboa, and Colon, Canal Zone, is practically completed. At Darien the aerial mast was hoisted in April, and tests of the radio equipment furnished by the Federal Telegraph Company are now in progress. The station is in regular communication with Arlington, Va., and has received messages from other distant points. At Colon and Balboa, which are secondary stations, the antennas are swung from the new 300-foot towers and the radio equipment is practically completed. The last wooden mast of the old Colon station will be taken down in the near future. These stations will be operated by the Navy Department, the operating force consisting of enlisted men of the Navy under the command of a commissioned officer.

## Production of Coal Briquets Increased.

A substantial increase in the quantity of coal briquets manufactured and sold in 1914 is announced by the United States Geological Survey, which compiles the annual figures for this industry.

The production of briquetted fuel in 1914 amounted to 244,635 short tons, valued at $1,123,178, an increase compared with 1913 of 62,776 short tons in quantity and $115,851 in value.

## Dr. Bell Lectures for Boston Engineers.

An interesting and valuable talk on "Modern Street Lighting Units" was presented by Dr. Louis Bell before the Boston Section, American Institute of Electrical Engineers, at the Engineers' Club, Boston, May 28. Chairman J. W. Palmer, Jr., presided, and announced that the section membership is now larger than ever before, numbering 455. A method of co-operating more fully with the Mechanical and Civil Engineering organizations in Boston is being considered by a committee of which Prof. H. E. Clifford is chairman.

A report of the nominating committee, was presented by Prof. W. E. Wickenden, with these nominations: Chairman, L. L. Elden; vice-chairman, George Burnham; secretary-treasurer, Ira M. Cushing; excutive committee, L. W. Abbott, W. L. Puffer, C. W. Green. These gentlemen were elected as the officers for the ensuing year.

Dr. Bell pointed out that street lighting is at the parting of the ways, and urged his hearers to improve the opportunity afforded. Present tendencies are toward the use of incandescent lamps, of a distinctly new type. This calls for great study, both along engineering and technical lines.

The first exhibition of the so-called high-power arc, in Madison Square, New York, 30 years ago, was recalled. Early installations for street service were on very tall poles, harking back to early schemes of lighting London and Paris by means of beacons hung aloft.

Improvements in operating details were brought about between 1883 and 1898, said Dr. Bell, but improvements in results were scanty. In 1893 he experimented with an alternating-current arc made by the Helios Company, which promised extraordinary results. The carbons required were, however, hard to obtain.

In 1898-9 the enclosed arc appeared, bringing about a radical change. It won its way largely by central-station advocacy, because it was cheaper to operate, the cost of trimming being minimized. It was inferior as a pure light giver, but steadier; distribution was somewhat improved, but candlepower was not increased. Its softer, high-grade carbons won favor for this type of lamp.

Six years later its inefficiency was discovered by comparison with the new flaming arc then brought out. There were objections to this type—its yellow light and comparative unsteadiness. White carbons were then applied, meeting American objections, though on the continent of Europe the yellow was preferred for street lighting and the white was used for advertising purposes, reversing our practice.

Disadvantages of the flame-arc lamp are its long carbons and fast burning, requiring frequent trimming. In the United States it never made its way, owing to maintenance cost, until the introduction of the long-burning improvement, which was obtained at some sacrifice.

In 1913, the high-powered incandescent lamp appeared. The tungsten lamp had not made a great impression on the street-lighting field, except in its small units. Meanwhile the magnetite arc had been perfected—a lamp nearly as efficient and superior in possible light of the electrode. This type is not in favor in Europe because not available for alternating currents.

The gas-filled lamp, consuming but 0.5, 0.6 or 0.7 watts per candle, said the speaker, is bound to displace all but the large and most powerful arcs.

Flaming arcs still have the advantage in point of absolute efficiency, in these large sizes. The type C incandescent, however, has the better of the four-ampere arc, is on even terms with the five-ampere, and is inferior to the 6.6-ampere magnetite. Its added claim to favor is in its absolute steadiness.

Small arcs are bound to be replaced, said Dr. Bell, but the larger ones will remain until the problem of ultimate efficiency has been worked out for both types. Renewal costs of the type C are still uncertain. Its life is being increased, but present renewal costs are a handicap, in competition with the cost and care of the arc lamp of best efficiency. The 500-watt C lamp, if kept at present cost, is likely to cut itself off in competition unless its life is increased or its efficiency raised to a possible one-third-watt claimed for it. The balance is in the manufacturers' hands. Flaming arcs and luminous arcs of the first class cannot be displaced by the best incandescent yet produced, the speaker thought.

In any change of street lighting system, the question of spacing the units arises: shall the replacing be on the plant of lamp for lamp, or shall there be new spacing and arrangement?

Replacements should always be with the aim of securing better illumination. When a type of lamp gives way to another, the newer type ought to be provide a better light, besides being to advantage as regards cost of operation and efficiency.

Should the number of lamps for a given length of street be increased? Arcs are often spaced at too great intervals, sometimes as great as 600 to 800 feet. Boston's spacing of 200 to 250 feet is not bad for its lamps of 1,000 candlepower. Generally, the number of units should be increased. Some cities, however, object to an increase, while in others the spacing is dominated by the layout of the streets, which forbids mid-spacing. In these cases the change in type of lamp will be made unit for unit. Under any circumstances the substitution of small incandescents at 75 feet for large arcs at 300 to 400 feet would not be a good change.

Large incandescent units cost as much to put up as big arcs, if refracting lenses are included. The smaller weight of the former demands a less substantial support, however. Present tendencies are in the direction of suspending the incandescents over the street area. Twenty-five or 30 feet above the middle of the street is better than over the curb. Cross suspensions, such as are used in Vienna, are with good effect. Diffusing globes are necessary for use with high-efficiency incandescent units. Even the 100 or 150-watt sizes are intolerable, owing to the brilliancy of the concentrated filament. The city of Hartford, Conn., has installed 250-candlepower units with frosted ground bulbs, with pleasing results. The chance of their becoming dirty was provided for by the central station's willingness to give them special care.

Greater freedom in fixtures is allowed, because there are no sharp shadows. Fixtures ought to be carefully studied. The reflector should be brought nearer the filament than is now common practice. Even in using Holophane reflectors the shape of the filament is such that it gives a variation in azimuth which should be provided against in the specifications.

The main point today, said the speaker, is to get rid of small arc lamps. Color differences are not so important as some think.

The lecture was illustrated by many slides which depicted illuminating fixtures used in street lighting in England, France, Germany and Switzerland. High-pressure gas arcs over the center of a street in Manchester, Eng., magazine arcs with small carbons in London, flame arcs and incandescents on a combination pole in Cologne, six-unit 1,000-candlepower carbon incandescent groups in Dresden, 40 feet above the street, 15-ampere arc lamps in Geneva, bracket lamps on buildings in Zurich, elaborate pylons in Berlin, and the Avenue de l'Opera, Paris, said to be the most brilliantly lighted street in Europe, were shown upon the screen.

S. C. Rogers, of the General Electric Company, Lynn, Mass., presented some stereopticon views of latest and most approved arc installations in Lynn, Swampscott and Beverly, Mass. The two former have the Holophane refractor. The Washington type of globe was shown, this having dense glass on the side toward the residences.

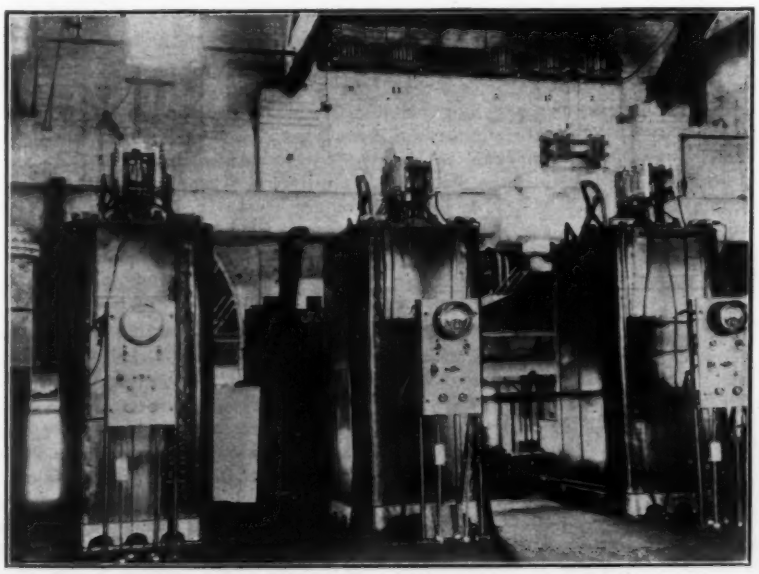
J. W. Cowles, of the Boston Edison Company, said the only type C lamp offered by that company to the municipalities of the territory is the 600-

Central Street, Lowell, Showing New Magnetite-Arc Lighting.

candlepower 6.6-ampere lamp. These are in some instances replacing series alternating-current 6.6-ampere arc units, with excellent results. The substitution of lamp for lamp, he thought to be a step in the right direction, but not a solution of the problem of good lighting. European street lighting as a whole he thought to be no better than American. Mr. Cowles advocated classifying street lighting more thoroughly, and distinguishing between the type of units best for main, secondary and residence streets. European lighting systems are classified: (1) Streets and squares of the first importance, which are thoroughly lighted, with small regard for expense; (2) intermediate streets, carrying large traffic but not requiring spectacular lighting; (3) side of residence streets.

"Let us concentrate our large units on the main streets," said Mr. Cowles, "and taper off to smaller units on the side streets." Mr. Cowles referred to the recent experiments in New York, conducted by the National Electric Light Association and the Association of Edison Illuminating Companies, which indicate uniform illumination not ideal, but certain shadow effects desirable.

Professor W. E. Wickenden, of the Massachusetts Institute of Technology, pointed out that few cities of medium size have men competent to judge or plan the best scheme of street lighting. He held that glassware which will remain clean longer is needed. Incandescent lamps of 250 to 800 candlepower he believed to be suitable for residence streets, and he urged more definite bargaining between cities and lighting companies.



Three of Rectifier Units for Lowell Street Lighting.

## Lowell, Mass., Installs New Ornamental Lighting System.

An improved ornamental street lighting system has been installed in Lowell, Mass., the public opening of the "White Ways" occurring May 28. The installation consists of 234 6.6-ampere magnetite-arc lamps, purchased, installed by the Lowell Electric Light Corporation, which furnishes the energy and cares for the lamps at a cost of about $16,000 a year. Forty-seven of the units are for all-night lighting and the rest burn until midnight.

The new lamps are fairly closely spaced, the maximum distance between units being 120 feet and the minimum 56 feet. So far as possible, lamps are located in alternate positions on opposite sides of the street. At intersecting streets a lamp is located on one corner and another directly opposite the side street, if the latter ends at the main thoroughfare. The whole extent of the newly lighted ways is about two miles.

Lamps are of the General Electric, form 10, inverted ornamental type, with cast-iron base and shaft. The center of arc is 14 feet 6 inches above the sidewalk. Alabaster globes and 18-inch electrodes of standard efficiency characterize these lamps, which have a mean hemispherical candlepower of about 850. They consume about 500 watts, 550 being allowed at the station.

The underground system consists of two-inch and 2.5-inch black-enameled steel conduit laid about 18 inches under the sidewalk level. The poles are anchored to concrete bases 20 inches square by 30 inches deep, and cast in collapsible wooden forms. Elbows of the conduit are cast in the concrete. The conduit, base of pole and lead sheath of the conductor are bonded together and grounded.

Inside the pole were installed two lengths of fibre conduit running from the cutout in the base of the pole to the porcelain insulators at its top. The leads are 10,000-volt, No. 1, twin-braided-covered, between the cutout and the lamp connections.

Cable was furnished by the Simplex Wire & Cable Company, Cambridge, Mass.; for the midnight lamps, No. 6 solid conductor, insulated with 10/32-varnished cambric, enclosed in lead sheath and rated at 10,000 volts working pressure, being used. This conductor has a test pressure for five minutes of 25,000 volts and is guaranteed for five years. On all-night circuits the same conductor is installed, but with insulation of six-thirty-second-inch and a working pressure of 7,500 volts. Some General Electric cable of about the same specifications was also employed.

The entire work of installation was by the lighting company's own employees, and required only 49 working

days. Local laborers were employed for the heavy work.

The station equipment in connection with the new lamps consists of four 75-lamp General Electric duplicate double-tube rectifiers of a type only recently produced. Three of the rectifiers are for the midnight circuits and one is for all-night circuits. They are installed in the company's standby station.

The Lowell company is under the management of the Stone & Webster Management Association, Boston. John A. Hunnewell is local manager, and John L. Collins superintendent of station apparatus. T. T. French, superintendent of the district, had charge of the installation.

## Cement-Plant Substation for Receiving Mississippi River Power.

The great Mississippi River Power Company's development at Keokuk, Iowa, has stimulated the use of electricity by many industrial enterprises and has made it profitable for many others to close down their private generating plants and use central-station power.

One of the largest private users of Mississippi River power is the Continental Portland Cement Company, located south of St. Louis, Mo., on the Iron Mountain Railway. This company has a connected transformer capacity of 3,000 kilovolt-amperes, which makes the plant particularly interesting and worthy of description.

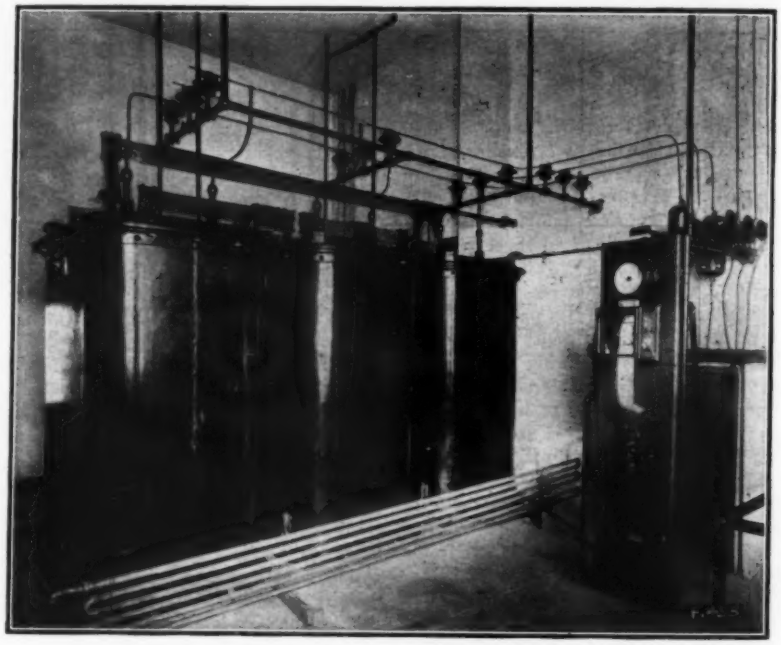
The plant superseded by Mississippi River Power service actuated at 25 cycles, making it unnecessary to provide frequency-changers to supply the motors now installed. Steam was generated by a battery of Stirling water-tube boilers. The generating equipment consisted of three cross-compound engines direct-connected to Westinghouse 25-cycle, 440-volt, three-phase alternators. The alternators were excited by two Western Electric generators direct-connected to two high-speed vertical engines. The switchboard consisted of three generator panels, one exciter panel, four feeder panels, and one regulator panel.

The new service line to the plant consists of No. 2 hard-drawn copper wire carried on 35-foot cedar poles. Thomas porcelain insulators having a large extra petticoat to provide extra large creepage surface on account of dust are supported on the usual cross-arms and steel pins. The line was constructed and is maintained by the Electric Company of Missouri, which is a distributing company in Missouri for Keokuk power.

The double entrance to the substation was made with Ohio Brass Company's 40,000-volt roof bushings. The substation itself is constructed of reinforced concrete. The equipment consists of three 1,000-kilovolt-ampere Wagner oil-filled water-cooled transformers, designed for 13,200-volt primary and 440-volt secondary. The primary coils are provided with 5 per cent taps to compensate for 20 volts line drop throughout the plant.

The primary bus consists of No. 00 hard-drawn copper supported on Thomas insulators, which in turn are mounted on 8-inch clamp pins fastened to 1.25-inch pipe framework, hanging from the reinforced-concrete roof.

The secondary bus consists of three 6-inch by one-fourth-inch copper straps per phase. The original layout for the secondary bus contemplated a connection with the bus of the steam plant through three 6,000-ampere single-pole laminated air-break switches on a vertical panel. The lower studs of the switches were to be connected to the secondary of the transformers through flexible cables. This was abandoned, however, in favor of the busbar connection. The secondary switchboard was dispensed with by cutting off the section containing the single-pole switches and mounting it on an angle-iron bracket fastened to the engine-room wall opposite the point where connection was to be made with the existing bus. Thus these switches act as plain disconnecting switches between the company's board and the transformers, and will never be opened under load. Electrolytic lightning arresters, switches and panelboards were furnished by the General Electric Company.



Interior of Substation Showing Transformers and Busbars.

The illustration shows the transformers and busbars in place. The pipes in the foreground were to provide warmth for the workmen during the cold weather.

The substation was designed by the Arrow Engineering Company, of St. Louis, Mo., and all equipment was installed under its supervision.

## Materials of Construction.

The materials of engineering construction will receive special attention in the proceedings and discussions of the International Engineering Congress, to be held in San Francisco, September 20 to 25.

The field will be treated under 18 or more topics, covering timber resources; preservative methods; brick and clay products in general; life of concrete structures; aggregates for concrete; waterproofing; volume changes in concrete; world's supply of iron; life of iron and steel structures; special steels; status of copper and world's supply; alloys; aluminum; testing of metals, of full-sized members, and of structures.

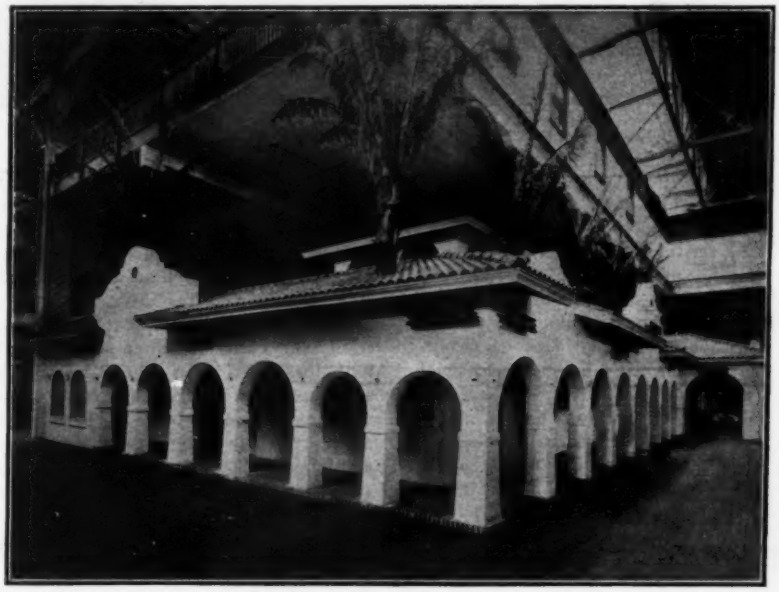
## Institution of Electrical Engineers.

The membership of the above English institution fell during 1914 from 7,045 to 6,811. New members received in all classes numbered only 279, but members lost numbered 513, making the net drop 234. Of the 513 lost, 54 died, 123 resigned and 244 "lapsed." The new members (279) include 171 who were "reinstated." The institution now has 928 members serving in the army and navy.

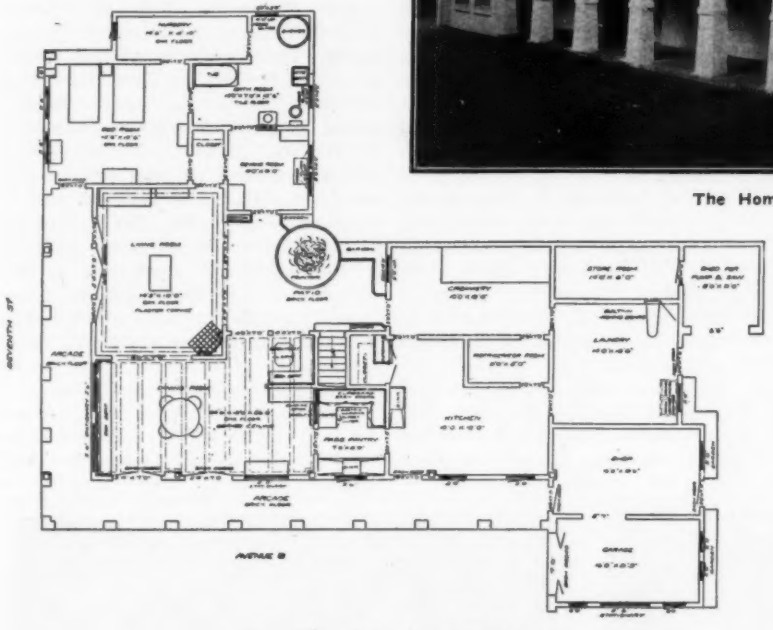
## "Home Electrical" at the Panama-Pacific International Exposition.

One of the most attractive exhibits at the Panama-Pacific International Exposition, to judge from the surprisingly large number of daily visitors, is the "Home Electrical" in the Palace of Manufactures. In this model home electricity is made to cook, wash, launder, sweep, dust and perform countless other domestic duties, as well as to heat, light and cool the house.

This exhibit, conducted by the General Electric Company, is co-operative to the extent that it comprises a very comprehensive display of devices operated by this company's motors, the devices themselves being the products of other manufacturers, many of whom have no other representation at the Exposition. It is quite in contrast with the usual manufacturer's exhibit, because it is broadly educational, completely operative and required a considerable expense compared with the immediate return that might be expected through the sale of the electrical material exhibited. It is quite evident that the broad idea governing the design of the exhibit was to popularize generally the use of electricity in the home.



The Home Electrical.



Floor Plan of the Home Electrical.

The "Home Electrical" is in every way a practical modern home. Not a single electrical convenience is shown but that would be entirely suitable for the average family and well within the means of a man of moderate income. It is of simple, Spanish-California, bungalow design and inexpensive. The building is of gray stucco, with a long columned portico on two sides, and is roofed with red tile. The interior consists of a large living room, dining room with breakfast alcove, bed room, nursery, sewing room, bath, kitchen, refrigerator room and laundry. There are also an electric garage, a workshop and a small creamery. The home is completely furnished and attractively decorated, all in good taste.

Beginning with the portico, or veranda, the workings of electricity are everywhere in evidence. The veranda is generously illuminated with Mazda lamps in suitable fixtures; the house number is an electric transparency, and electric bells operated by transformers announce your presence at any door. The living room, spacious and appropriately furnished, is lighted with Mazda lamps placed in semidirect fixtures, the light being diffused and distributed by reflection from tinted walls and ceilings. An electric "fireplace" of the luminous-radiator type furnishes both warmth and pleasing light. The electric piano player will entertain visitors either with classical or popular selections.

Adjoining the living room is the dining room, also suitably furnished. This room is lighted by Mazda lamps in fixtures, which provide direct illumination through tinted shades. It is heated by electricity, and the air is kept constantly stirred and refreshed by a small electric fan. The dining room is equipped with electric heating devices for the preparation of lunches and light refreshments. There is a radiant toaster, an electric coffee pot, a tea samovar, a disk stove for general cooking, a uni-set, a chafing dish for preparing hot soups or desserts, and an electric grill for broiling, toasting, preparing eggs, etc. If desired, a very substantial meal can be cooked on the dining-room table. Another electrical feature is the warming closet at the entrance to the butler's pantry, where the food is kept hot between courses. To the right of the dining room is the breakfast alcove, very cosily arranged and also equipped for "table cooking." This breakfast nook looks out upon a vine-covered patio, upon ferns and flowers and a little green yard, wherein trickles a tiny spring.

Between the dining room and the kitchen is the butler's pantry. In it is installed a combination butler's sink and dishwasher for cleaning the light and valued wares. On a shelf there is a disk stove for making dressing and sauces, and a small electrically-driven buffer for polishing nickel and silver pieces. On the wall is the

Breakfast Room.

Bedroom.

annunciator of the door-bell system, which signals information to the maid or butler.

In the kitchen, which is the workshop of every home, electricity finds its greatest field of usefulness. An electric range, equipped with hot plates, broiler and ovens, is ready to cook the largest family dinner. A constant supply of hot water is insured by an electric water heater attached to the usual kitchen water tank. The unpleasant odors of cooking are not noticed, as a household ozonator and exhaust fan combine to remove them quickly and keep the air in the kitchen pure and fresh. Should the day be chilly, a portable air heater can be put into service by inserting a small wall plug. A new device, which does away with dirty and impure ice, is the electrically lighted and cooled refrigerator, where small cubes of ice also may be obtained. There is also an electrically driven ice-cream freezer, if home-made ices and creams are desired. A connection with the inter-house telephone for saving steps is the final kitchen convenience.

The bedroom contains many electrical conveniences and articles for the toilet, including an electric massage vibrator, electric curling iron, hair dryer and boudoir lamps. There is a heating pad to take the place of the old-time hot-water bag and a small electric water heater in case of sickness. The bedroom is heated by electricity in chilly weather and cooled with an electric fan when the nights are too warm. There is a connection for the vacuum cleaner. The room is also provided with a telephone connection to all parts of the house, to save unnecessary steps. Most interesting of all the electrical appliances in the bedroom is the burglar switch, which, when needed, lights every lamp in the house.

Near the bedroom is the nursery with its electric toys and an electrical device at the window to keep the room supplied with fresh air without dangerous drafts. The nursery is heated by electricity, and there is an electric nursery outfit for preparing medicine, food, etc., in case of sickness. An electric heating pad is also provided to warm up cold hands and toes.

The bathroom is finished in white tile and porcelain. In addition to a complete set of bathroom fittings in porcelain, there are such electrical conveniences as a hot-water cup for shaving, a glowing electric radiator, an electric vibrator and a hair dryer. An exhaust fan and an electric ozonator prevent impure or vitiated air, and draw the steam from the hot water out of the room. The hot water for the bathroom is drawn from the hot-water tank in the kitchen.

Every housewife visiting the "Home Electrical" takes great interest in the sewing room with its electric appliances for sewing, mending and dressmaking. The sewing machine is operated by an electric motor controlled by the foot treadle. A three-pound and a six-pound electric iron are located on a convenient board, and a small portable vacuum cleaner is used to pick up threads and scraps of cloth without effort. A connection to the inter-house telephone saves many steps in tending to various household duties during sewing hours. A small air heater and a fan keep the room warm and comfortable at all seasons.

The home is equipped with a complete electrical laundry. There is a quiet-running washing machine and an electric mangle, which may be en-

Kitchen.

Laundry.

trusted with delicate pieces; three, six, eight and twelve-pound irons for any ironing and pressing which may need to be done, and a double eight-inch hot plate for boiling the clothes. A collapsible ironing board folds into a shallow closet, and the flatiron switch is equipped with a pilot light to indicate whether or not the current has been turned off. An air heater and exhaust fan provide comfortable working temperature under all weather conditions.

Provision has been made, in the shed, for constant water pressure all over the house when the water supply is a well or spring. Here is installed an automatic air-pressure system connected to the water supply, keeping the pressure constant at any desired point. The air pump is driven by a small electric motor, controlled by a pressure switch.

Nearly every home has a workshop where the man-of-the-house builds and repairs. This is, perhaps, more true of country places, and it must be remembered that the "Home Electrical" is by no means restricted to city folk. The shop is equipped for any ordinary repair or construction work, with a work bench, bench-type drill press, chipping hammer, electric riveter and grindstone. Then there is a buffing outfit, saw table, bench-type lathe and metal melting pot, all electrically operated. Handy little electric soldering irons and an electric glue pot aid in repairing leaky utensils or broken woodwork. An air heater of sturdy build and generous capacity is ready at all times to insure comfort in the shop.

In the garage is a light electric coupe, which is kept charged automatically by a mercury-arc rectifier. The lighting batteries are charged by a small vibrator. A small portable search lamp, which can be operated on any electrically lighted car, is used for close examination of any part of the car, and a portable electric tire pump complete the car equipment. Connections are made to the inter-house telephone in both garage and workshop. An air heater is also installed in the garage.

Garage of the Home Electrical.

Of particular interest to the visitor from rural communities is the dairy. This is equipped with an electrically driven cream separator, bottle washer and churn. In conjunction with these appliances is an automatic refrigerator and milk cooler, operated by a thermostat to keep the temperature of the cooling chamber at the proper point.

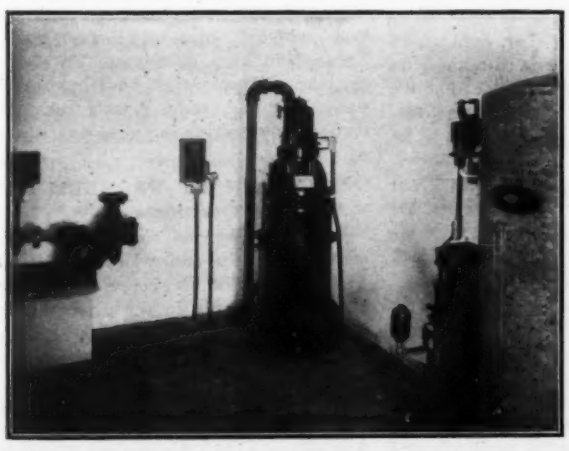
More than anything else, the "Home Electrical" emphasizes the fact that electricity is readily adaptable to all kinds of domestic service where light, heat and power are required. All these electrical conveniences are inexpensive, and most of them cost no more to use than an electric iron. In fact, in many homes it is entirely possible to install many of these things without extra operative costs, by taking out the old current, consuming carbon incandescent lamps and replacing them with new Mazdas. These save fully two-thirds of the current; and this can be used to run fans, cooking devices, vacuum cleaners, etc., without increasing the monthly lighting bill.

## Water Resources of Southern Rivers.

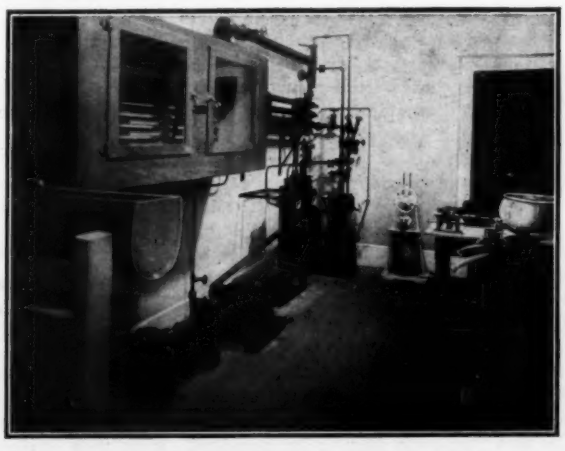
Measurements of stream flow have been made by the United States Geological Survey at about 3,000 points in the United States, and also at many points in small areas in Seward Peninsula and the Yukon-Tanana region, Alaska, and in the Hawaiian Islands. In July, 1913, 1,388 gauging stations were being maintained by the Survey and the co-operating organizations, and many miscellaneous discharge measurements were made at other points. In connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country.

One of these reports, entitled "Surface Water Supply of the Lower Mississippi River Basin, 1913," by Robert Follansbee and G. A. Gray, contains records of the flow of rivers in the Arkansas, Yazoo and Red River basins, tributary to the lower Mississippi, during 1913. Forty-one stations were maintained in the basins of these rivers during the year. The Arkansas River records cover the principal upland tributaries in Colorado, together with Canadian River in New Mexico and White River in Arkansas and Missouri. The records in the Yazoo River drainage basin were procured in co-operation with the Tallahatchie Drainage Commission and are of fundamental importance in connection with drainage work in this fertile delta region.

A copy of the report may be obtained free on application to the Director of the Geological Survey, Washington, D. C.



Shed for Stationary Vacuum-Cleaning Outfit and High-Pressure Pumping System.



Creamery in the Home Electrical, Panama-Pacific International Exposition.

# Electrical Engineering Problems.

By R. G. Hudson and W. V. Lyon.

## DIRECT CURRENTS.

**Problem 39.**

A public hall 60 feet wide, 100 feet long and 25 feet high has an unbroken white ceiling and is to be illuminated by tungsten lamps mounted in silvered reflectors and placed close to the ceiling. The power rating, lumens, life and cost of certain sizes of vacuous tungsten lamps are as follows:

| Rated watts. | Lumens. | Life in hours. | Cost. |
|---|---|---|---|
| 100 | 908 | 1,000 | $0.70 |
| 150 | 1,430 | 1,000 | 1.10 |
| 250 | 2,450 | 1,000 | 1.80 |
| 400 | 4,070 | 1,000 | 2.90 |

Assuming that one-half of the lumens emitted by each lamp are absorbed by the reflector, ceiling and side-walls, and that the average illumination on a plane three feet from the floor is to be three lumens per square foot, find (*a*) the proper size and location of the lamps and (*b*) the annual cost of lighting this hall, including the cost of lamp renewal, if the electric energy costs 10 cents per kilowatt-hour and the hall is used four hours in the evening 100 times a year.

### SOLUTION OF PROBLEM 39.

To facilitate visualization and computation it is assumed that all sources of light emit a luminous flux which, when reflected from an object into our eyes, enables us to see the object. The lines of light constituting this flux are called lumens. The number of lumens emitted from any source of light is arbitrarily taken as $4\pi$ times the mean luminous intensity or mean spherical candlepower of the source.

If a 100-watt tungsten lamp is compared photometrically with a standard lamp it is found to have a mean spherical candlepower of 72.3 candles. Such a lamp is then said to emit $4\pi \times 72.3$ or 908 lumens. These lumens are emitted in varying degrees of density about the lamp and if designed to illuminate any given plane surface, a reflector of some kind should be placed about the lamp so that as many as possible of the lumens may be directed upon the surface to be illuminated.

The human eye operates most effectively when the number of lumens striking a light-diffusing surface ranges from 1 to 5 lumens per square foot. The incident luminous flux per square foot on any surface is called the illumination of the surface. An illumination of one lumen per square foot is also called an illumination of one foot-candle.

The area of the hall described in Problem 39 is 60×100 or 6,000 square feet and since the illumination over this area is to be 3 lumens per square foot, the net luminous flux to be provided must be 6,000×3 or 18,000 lumens. If it is assumed that one-half of the lumens emitted by the lamps are absorbed by the reflectors, ceiling and side-walls, the gross luminous flux which must be emitted by the lamps will be 2×18,000 or 36,000 lumens.

The number of lamps required then depends upon the size of the lamps adopted, and for any given size the number of lamps equals 36,000 divided by the lumens emitted per lamp. Large lamps are more efficient than small lamps and since a smaller number are required in any given case the cost of the fixtures and wiring will be less. Small lamps, owing to the greater number required, will give a more uniform illumination than a few large lamps. In addition to these considerations the size of lamp chosen depends to some extent upon the height of the ceiling, large lamps being placed higher than small lamps to avoid glare. The usual heights at which various lamps are placed above the working plane are as follows: 100-watt, 12 to 16 feet; 150-watt, 14 to 20 feet; 250-watt, 17 to 27 feet; 400-watt, 25 to 35 feet. No data have been given for lamps rated from 10 to 60 watts, because such lamps could not be used effectively under the conditions described.

**Answer to Question a.**

Since the height of the ceiling is 25 feet and the working plane is 3 feet from the floor, the distance from each lamp to the working plane, assuming a distance from the lamp to the ceiling of one foot, will be about 21 feet. The 250-watt lamp then appears to be well adapted to the conditions, and since such a lamp emits 2,450 lumens, the number of lamps required will be 36,000/2,450 or 15 lamps.

The ceiling must now be divided into 15 squares each, 6,000/15 or 400 square feet in area, and a lamp is then located in the center of each square. A reflector should be selected which will direct most of the light within a square 20 feet on a side and 21 feet away from the lamp. There will then be three rows of lamps with five lamps in each row. If 150-watt lamps had been selected there would have been 36,000/1,430 or 25 lamps, each located in the center of an area of 6,000/25 or 240 square feet. It may be seen from this that the arrangement of 150-watt lamps will not be as symmetrical as that obtained with 250-watt lamps.

**Answer to Question b.**

The power absorbed by fifteen 250-watt lamps equals 3,750 watts or 3.75 kilowatts and the energy absorbed in 400 hours equals 3.75×400 or 1,500 kilowatt-hours. At 10 cents per kilowatt-hour this energy will cost $150. Since each lamp costs $1.80 and the life is 1,000 hours, the depreciation charge of fifteen lamps in 400 hours must be 15 ×400×$1.80/1,000 or $10.80. The annual cost of lighting the hall is then $150+ $10.80 or $160.80.

It should be noted, in view of the fact that the cost of the energy is much greater than the cost of the lamps, that nothing can be saved by the use of cheap, inefficient lamps, since the saving in the cost of the lamps is more than counterbalanced by the increased cost of energy.

For the same reason it is usually wasteful to use any set of lamps longer than their rated life. While a lamp may be in good mechanical condition at the end of its rated life, its candlepower will have fallen to about 80 per cent of the original candlepower, so that the lamp will only give 80 per cent of the light given by a new lamp. To obtain the same illumination as when originally installed, more lamps must be turned on, resulting in an increased cost of energy.

### SOLUTION OF PROBLEM 89.

**Answer to Question a.**

In this problem an air-core reactor is used so that the entire loss will be the joule heating in the copper conductor. If there were iron in the magnetic circuit there would be both eddy-current and hysteresis losses. While the copper loss is practically independent of the frequency—if the frequency is not high—the iron losses vary more rapidly than as the first power of the frequency. Since the effective resistance of a circuit is the

## ALTERNATING CURRENTS.

**Problem 89, Part I.**

An air-core reactor is connected in series with a condenser. The reactor has a resistance of 5 ohms and an inductance of 25 milhenrys. The condenser has a capacity of 31.2 microfarads. An analysis of the wave form of the voltage impressed on this circuit shows that it contains a fundamental with a maximum value of 300 volts, a third harmonic with a maximum value of 100 volts, and a fifth harmonic with a maximum value of 80 volts. The fundamental frequency is 60 cycles. The higher harmonics are so small as to be negligible. (*a*) What are the ampere values of the fundamental, the third and the fifth harmonic currents? (*b*) What is the total current? (*c*) What is the voltage across the reactor? What is the voltage across the condenser? (*d*) What is the power supplied to the circuit?

**Part II.**

An air-core reactor is connected in parallel with a condenser. The reactor has a resistance of 5 ohms and an induction of 25 milhenrys. The condenser has a capacity of 30.3 microfarads. The same voltage wave as in Part I is impressed on this circuit. (*a*) What are the ampere values of the fundamental, the third harmonic and the fifth harmonic currents supplied to this circuit? (*b*) What is the total current? (*c*) What is the current in the reactor? What is the current in the condenser? (*d*) What is the power supplied to the circuit?

power loss divided by the square of the current, this is only constant when there is no iron loss. For this reason it is much simpler to use an air-core reactor.

In a problem of this sort where the voltage impressed on the circuit consists of a fundamental sine wave plus various harmonics, the solution is based on the principle that one harmonic in the voltage has no effect on the current produced by another harmonic in the voltage. For example, if a 25-cycle generator and a 75-cycle generator—these correspond to a fundamental and a third harmonic—were connected in series to a circuit like that described in this problem, there would exist in the circuit a current having two components. One of these components would be a 25-cycle current of the same value that it would have if this generator were connected to the circuit *alone*. The other component would be a 75-cycle current of the same value that it would have if the 75-cycle generator were connected to the circuit *alone*. The two, or more, components are entirely independent of one another. This would not be true, however, if there were iron losses, since the permeability of the iron when considering one frequency would be affected by the amount of current there was of the other frequencies.

The reactance of a condenser is

$$x_c=10^6/6.28fC$$

when $C$ is the capacity of the condenser expressed in microfarads. Compare this with formula [9a]. The reactance of a condenser is less the larger the frequency. This is exactly opposite to the effect of inductance. When an inductance and a condenser are connected in series the resulting reactance is equal to the difference between their reactances. At the fundamental frequency of 60 cycles the reactances are

$$x^1{}_L=6.28\times60\times0.025$$
$$=9.43 \text{ ohms.}$$
$$x^1{}_c=10^6/6.28\times6\times31.2$$
$$=85 \text{ ohms.}$$

The resultant reactance is

$$x^1=85-9.43$$
$$=75.6 \text{ ohms.}$$

The capacity is predominant.

The impedance at 60 cycles is

$$Z^1=\sqrt{5^2+75.6^2}$$
$$=75.8 \text{ ohms.}$$

The effective (or square-root-of-mean-square) value of a sine wave is the maximum value divided by $\sqrt{2}$.

The fundamental current (ampere value) is

$$I_1=300/\sqrt{2}\times75.8$$
$$=2.80 \text{ amperes.}$$

For the third harmonic, *i. e.*, at 180 cycles,

$$x'''{}_L=6.28\times180\times0.025$$
$$=28.3.$$
$$x_c{}'''=10^6/6.28\times180\times31.2$$
$$=28.3.$$

The resultant is

$$x'''=28.3-28.3$$
$$=0.$$

That is, at this frequency the inductance and capacity neutralize each other and the circuit acts, as far as the current goes, as if it consisted entirely of a resistance of 5 ohms. The circuit is said to be adjusted for resonance for the third harmonic. The third harmonic current is

$$I_3=100/\sqrt{2}\times5$$
$$=14.1 \text{ amperes.}$$

When a circuit is adjusted for resonance for any harmonic, that harmonic can be made much greater than any other component of the current.

For the fifth harmonic, *i. e.*, at a frequency of 300 cycles,

$$x^v{}_L=6.28\times300\times0.025$$
$$=47.1$$
$$x^v{}_c=10^6/6.28\times300\times31.2$$
$$=17.0.$$

The resultant reactance is

$$x^v=47.1-17.0$$
$$=30.1 \text{ ohms.}$$

The inductance predominates. The impedance at 300 cycles is

$$Z^v=\sqrt{5^2+30.1^2}$$
$$=30.5 \text{ ohms.}$$

The fifth harmonic current is

$$I_5=80/\sqrt{2}\times30.5$$
$$=1.86 \text{ amperes.}$$

**Answer to Question b.**

In a series circuit where the total current is made up of a number of components of different frequencies, the effective value of the total current is the square root of the sum of the squares of the various components.

[43a] $$I=\sqrt{I_1^2+I_3^2+I_5^2+\ldots\ldots}$$

In this case

$$I=\sqrt{2.8^2+14.1^2+1.86^2}$$
$$=14.5 \text{ amperes.}$$

**Answer to Question c.**

The voltage across the reactor consists of three components: a fundamental, a third harmonic and a fifth harmonic. Each component of the voltage equals the corresponding component of the current multiplied by the impedance of the reactor at that frequency.

$$V_{L1}=2.8\sqrt{5^2+9.43^2}$$
$$=29.9$$
$$V_{L3}=14.1\sqrt{5^2+28.3^2}$$
$$=406$$
$$V_{L5}=1.86\sqrt{5^2+47.0^2}$$
$$=88.0.$$

As in the case of the current, when a number of voltages of different frequencies act in the same circuit the resultant voltage is

[44a] $$V=\sqrt{V_1^2+V_3^2+V_5^2+\ldots\ldots}$$

In this case the voltage across the reactor is

$$V_L=\sqrt{29.9^2+406^2+88^2}$$
$$=416 \text{ volts.}$$

The voltage across the condenser is

$$V_{c1}=2.8\times85$$
$$=238$$
$$V_{c3}=14.1\times28.3$$
$$=400$$
$$V_{c5}=1.86\times17$$
$$=31.6.$$

By [44a] $$V_c=\sqrt{238^2+400^2+31.6^2}$$
$$=466 \text{ volts.}$$

Observe that the third harmonic com-

ponent of the voltage is very large, much larger than the impressed voltage, which is

by [44a] $V=\sqrt{300^2+100^2+80^2}/\sqrt{2}$
$=231$ volts.

The $\sqrt{2}$ is used since the *maximum* values of the components are given.

Whenever a circuit is adjusted for resonance, by the proper choice of resistance and reactances, the voltages across the reactor and the condenser may be made much larger than the impressed voltage. Unless provided for, this rise in voltage may be so great as to be very dangerous.

**Answer to Question d.**

The power supplied to such a circuit equals the square of the total current multiplied by the resistance of the circuit. Or it may be calculated by applying formula [1a], viz., $P=EI\cos\theta$, using the current, voltage and power-factor for one frequency at a time quite independent of the effects produced by the other harmonics. The total power is the sum of the powers due to the component harmonics.

$P=14.5^2\times5$
$=1{,}052$ watts.

Or by [1a] and [6a]

$P=(300/\sqrt{2})\times2.8\times5/75.8$
$+(100/\sqrt{2})\times14.1\times5/5$
$+(80/\sqrt{2})\times18.6\times5/30.5$
$=39.+1{,}000+17$
$=1{,}056$ watts.

The difference of 4 watts in the two methods is on account of the inaccuracy of the slide rule.

A series circuit that is adjusted for resonance for one particular harmonic is sometimes called a filter, since it strains out almost completely all of the current except this harmonic.

**Part II.**

The method of solution is similar to that employed in Part I, except that in parallel circuits formulas [11a] to [17a] involving the conductance and susceptance are used.

The conductance $g=r/Z^2$
The susceptance $b=x/Z^2$.

In the case of a perfect condenser, as this one is supposed to be, the conductance is

$g=0/x^2$
$=0$

and the susceptance $b=x/x^2$
$=1/x$.

If the condenser is a leaky one or if there is a power loss in it—these values of $g$ and $b$ do not hold. In such a case the current, voltage and power input should be measured. The values of the conductance and susceptance are then determined by formulas [11a], [12a] and [13a].

The reactances and impedances of the reactor at the different frequencies were calculated in Part I. The reactances of condenser at the different frequencies are

$x'_c=10^6/6.28\times60\times30.3$
$=87.6$ ohms.

At 180 cycles $x'''_c=29.2$ ohms.
At 300 cycles $x_c^v=17.5$ ohms.

The conductance and susceptance of the coil at 60 cycles are

$g_L{}'=5/(5^2+9.43^2)$
$=0.0439$
$b_L{}'=9.43/(5^2+9.43^2)$
$=0.0827$.

The susceptance of the condenser at 60 cycles is

$b_c{}'=1/87.6$
$=0.0114$
By [14a] $G'=0.0439+0$
$=0.0439$

In combining two *susceptances* in *parallel*, one of which is due to inductance and the other to capacity, the resulting susceptance is the difference between the two values, just as is the case when two such *reactances* are combined in *series*.

$B'=0.0827-0.0114$
$=0.0713$
By [13a] $Y'=\sqrt{0.0439^2+0.0713^2}$
$=0.0838$
By [11a] $I_1=300\times0.0838/\sqrt{2}$
$=17.8$ amperes.

This is the fundamental component of the current taken by the entire circuit.

The conductance and susceptance of the coil at 180 cycles are

$g_L{}'''=5/(5^2+28.3)^2$
$=0.00606$
$b_L{}'''=28.3/(5^2+28.3^2)$
$=0.0343$.

The susceptance of the condenser at 180 cycles is

$b_c{}'''=1/29.2$
$=0.0343$
By [14a] $G'''=0.00606+0$
$B'''=0.0343-0.0343$
$=0.00606$
$=0.0$

That is, at this frequency the inductance and capacity neutralize each other and the parallel branches act as if they consisted of non-inductive resistance as far as the total current supplied to them is concerned. With a non-inductive resistance, the conductance, $g$, is the reciprocal of the resistance, $r$. Thus the equivalent resistance of these parallel branches at 180 cycles is

$R'''=1/G'''=1/0.00606$
$=165$ ohms.

Observe that this equivalent resistance is many times larger than the true resistance of the coil.

In this case $Y'''=G'''$
By [11a] $I_3=100\times0.00606/\sqrt{2}$
$=0.43$ amperes.

Resonance in a series circuit results in a large current while resonance in a parallel circuit results in a very small one.

The conductance and susceptance of the coil at 300 cycles are

$g^v{}_L=5/(5^2+47^2)$
$=0.00224$
$b^v{}_L=47/(5^2+47^2)$
$=0.021$.

The susceptance of the condenser at 300 cycles is

$b^v{}_c=1/17.5$
$=0.0571$.
By [14a] $G^v=0.00224+0$
$=0.00224$
$B^v=0.0571-0.021$
$=0.0361$.

The effect of the capacity predominates.

$Y^v=\sqrt{0.0571^2+0.0361^2}$
$=0.0676$.
By [11a] $I_5=80\times0.0676/\sqrt{2}$
$=3.83$ amperes.

Observe that when two circuits connected in parallel are adjusted for resonance the component current of the resonant frequency is very small compared with the other components. This gives a method for practically cutting out any one harmonic component. This is exactly the opposite of the result attained when the circuits are connected in series and adjusted for resonance.

**Answer to Question b.**

The total current is

By [43a] $I=\sqrt{17.8^2+0.43^2+3.83^2}$
$=18.2$ amperes.

**Answer to Question c.**

The current taken by the reactor consists of three components which are

by [3a] $I_{L1}=300/(\sqrt{2}\times\sqrt{5^2+9.43^2})$
$=19.9$
$I_{L3}=100/(\sqrt{2}\times\sqrt{5^2+28.3^2})$
$=2.46$
$I_{L5}=80/(\sqrt{2}\times\sqrt{5^2+47^2})$
$=1.2$.

The total current taken by the reactor is

by [43a] $I_L=\sqrt{19.9^2+2.46^2+1.2^2}$
$=20.1$ amperes.

The current in the condenser consists of three componnets which are

by [3a] $I_{c1}=300/(\sqrt{2}\times87.6)$
$=2.42$
$I_{c3}=100/(\sqrt{2}\times29.2)$
$=2.42$
$I_{c5}=80/(\sqrt{2}\times17.5)$
$=3.23$.

The total current taken by the condenser is

by [43a] $I_c=\sqrt{2.42^2+2.42^2+3.23^2}$
$=4.71$ amperes.

**Answer to Question d.**

Since the condenser is assumed to be a perfect one—that is, one which absorbs no power—the entire power is absorbed by the reactor. This power equals the square of the total current in the reactor multiplied by its resistance

$P=20.1^2\times5$
$=2{,}020$ watts.

The power supplied to the circuit may also be found by computing that supplied at each frequency by formula [12a] and then adding the components

$P=(300/\sqrt{2})^2\times0.0439$
$+(100/\sqrt{2})^2\times0.00606$
$+(80/\sqrt{2})^2\times0.00224$
$=1{,}980+30+7$
$=2{,}017$ watts.

**Problem 40.** **DIRECT CURRENTS.**

The specifications for wiring a machine shop call for electrical connections between a service panel and four motors designated as A, B, C and D. The motors are 220-volt direct-current compound-wound machines and are rated as follows: A, 25 horsepower at 94 amperes; B, 10 horsepower at 38 amperes; C, 40 horsepower at 150 amperes; and D, 30 horsepower at 113 amperes. The voltage at the service panel is 230 volts and the voltage at each motor is not to be less than 220 volts at full load.

All wires are to be laid in rigid conduit and the wiring distances from the panel to the motors are as follows: A, 200 feet; B, 300 feet; C, 150 feet; and D, 100 feet. The cost of two rubber-covered wires and conduit per 100 feet for various standard sizes of wire is approximately as follows:

| Size of wire. | Cost per 100 feet. | Size of wire. | Cost per 100 feet. |
|---|---|---|---|
| 14 | $ 6.82 | 3 | $24.40 |
| 12 | 8.68 | 2 | 28.40 |
| 10 | 9.52 | 1 | 33.80 |
| 8 | 13.40 | 0 | 42.50 |
| 6 | 16.20 | 00 | 47.40 |
| 5 | 20.70 | 000 | 53.60 |
| 4 | 22.50 | 0000 | 60.90 |

In previous work of similar character the contractor finds that an electrician (55 cents per hour) and a helper (30 cents per hour) can install 30 feet of conduit per hour, including the drawing in of wire and setting of outlet boxes. Previous business indicates a "material overhead" of $5.00 per $100 paid out for material and a "labor overhead" of 20 cents per man-hour. If the contractor is to make a profit of 15 per cent, what amount should he bid on this job, if the service panel and switches cost $30.00?

**ALTERNATING CURRENTS.**

**Problem 90. Part I.**

Three equal circuits each of which consists of an air-core reactor in series with a condenser are connected in star across the terminals of a three-phase, 60-cycle generator. The reactor has a resistance of 20 ohms and an inductance of 25 milhenrys. The condenser has a capacity of 30 microfarads. The armature windings of the generator are connected in star, and an analysis of the phase voltage shows that it consists of a fundamental with a maximum value of 150 volts, a third harmonic with a maximum value of 50 volts and a fifth harmonic with a maximum value of 40 volts. The higher harmonics are too small to consider. (*a*) What will a voltmeter indicate that is connected across one phase of the generator, *i. e.*, from line to neutral? Across the lines? Across one phase of the load, *i. e.*, from line to the neutral of the load? (*b*) What will a voltmeter indicate that is connected between the neutral point of the generator and the neutral point of the load? (*c*) What are the voltages across each reactor and across each condenser? (*d*) What is the line current? If the output of the generator is measured by the two-voltmeter method, what will be the sum of the wattmeter readings? Is this the output of the generator?

**Part II.**

The neutral point of the generator is now connected to the neutral point of the load. Assume that this does not alter the phase or the line voltages of the generator. (*a*) What is the line current? (*b*) What is the current in the conductor connecting the neutral points? (*c*) What are the voltages across each reactor and across each condenser? (*d*) If the wattmeters are still connected as in Part I, what will be the sum of their readings? (*e*) What is the total output of the generator?

## The Engineering Foundation.

There was held on May 25 the first regular meeting of the Engineering Foundation, at which rules of administration were adopted, and the following officers elected: Chairman, Gano Dunn; vice-chairman, Edward D. Adams; secretary, F. R. Hutton; treasurer, Joseph Struthers. This is a professional engineering trust, organized along the lines of the Cleveland, Carnegie, Rockefeller and Sage Foundations, by the United Engineering Society, representing the national organization of electrical, mining and mechanical engineers, with the co-operation of the national organization of civil engineers, combining about 30,000 members.

The Engineering Foundation was made possible through the generosity of Ambrose Swasey, of Cleveland, who made the initial gift of a quarter million dollars to be devoted to the benefit of mankind, through fostering engineering research. The board administering this trust consists of Edward D. Adams, banker; Gano Dunn, president of the J. G. White Engineering Corporation; Howard Elliott, president of New York, New Haven & Hartford Railroad; Alexander C. Humphreys, president of Stevens Institute of Technology; Charles Warren Hunt, secretary of the American Society of Civil Engineers; A. R. Ledoux, past-president of American Institute of Mining Engineers; M. I. Pupin, professor in Columbia University; Charles E. Scribner, chief engineer of Western Electric Company; J. Waldo Smith, chief engineer, Board of Water Supply, Gas and Electricity, City of New York; Jesse R. Smith, past-president of American Society of Mechanical Engineers, and Benjamin B. Thayor, president of Anaconda Copper Company.

The board telegraphed Mr. Swasey greetings and appreciation of his generosity, and pledged itself to carrying out his cherished aims.

Applications for the use of funds were received in large numbers and a committee was appointed to consider them, consisting of A. R. Ledoux, chairman; J. Waldo Smith, M. I. Pupin, and Alexander C. Humphreys. Most of the applications were in such form that they could not be considered and the committee is preparing a schedule of requirements with which applications will have to comply.

The Engineering Foundation is the first of its kind devoted to engineering interests.

## Chicago Electric Club.

At the meeting of the Electric Club-Jovian League of Chicago on May 27, a talk was given by Fay Cooper Cole on "Wild Tribes of the Philippines." This was illustrated by beautifully colored lantern slides.

## Lighting of Long Viaduct.

The lighting arrangements on the recently completed Ludlow Avenue viaduct, in Cincinnati, constructed for the purpose of eliminating the crossing at grade by street cars and other traffic of the Baltimore & Ohio Railroad Company's tracks, contain several features of interest. These lie not only in the fact that the viaduct is an extremely long one, measuring with its approaches, 1,800 feet, but that all of the electrical connections were made and the standards installed after the viaduct proper was completed.

This was due to the fact that the type of lighting to be adopted was not determined upon in time for proper arrangements to be made for its accommodation during the construction of the viaduct itself, which is of concrete, and it was consequently necessary for the electrical contractor, the DeVere Electric Company, to adapt its methods to that fact. This was not found difficult, however, the only effect being to make the work somewhat slower and slightly more expensive than it would otherwise have been. The lighting system, as it stands, is notably efficient in operation and attractive in appearance.

The posts used are of the single-light type, of cast iron, weighing approximately 600 pounds each and designed for use in connection with a Holophane globe. A 500-watt type C Mazda lamp is used in each. The globe is of clear glass.

There are 36 posts placed opposite each other, on the two sides of the viaduct, at intervals slightly less than 100 feet. Their efficiency is such that notwithstanding this distance, and the fact that the viaduct is 60 feet wide, with 40 feet between the curbs, the illumination given at night is ample to keep the structure well lighted, as the accompanying photograph clearly shows.

Energy is taken from one of the lines of the Union Gas & Electric Company at a point near the viaduct, the wire being run underground, thence in four-inch lead-covered conduits, imbedded in concrete, to the viaduct.

Lighting of Ludlow Avenue Viaduct, Cincinnati, O.

## Electrifying the Anthracite Coal Mines.

The substitution to a large extent of electricity for the direct use of both steam and compressed air in the anthracite mines of Pennsylvania is foreseen as a possiblity in a paper read before the Engineers' Society of Northeastern Pennsylvania. The data for this "Historical Review of the Use of Electricity in the Mining and Preparation of Anthracite Coal in the State of Pennsylvania" was gathered last summer by a committee of electrical engineers, of which H. M. Warren, of the Delaware, Lackawanna & Western Railroad Company, was chairman.

In a summary of apparatus in service at the conclusion of the paper, the grand total of electric generating capacity and power purchased for use at the mines is given as 79,811 kilowatts, which is approximately equal to 105,400 horsepower. The horsepower produced by steam at the mines is given as 531,289 in the last annual report of the Bureau of Mines of Pennsylvania. As 91,010 of this is used for electricity, this leaves 440,279 horsepower produced by steam for direct use. Thus almost a fourth as much power is used electrically at the mines as is produced by steam for direct use.

The introduction of electricity in any great quantity into the mines is not more than two decades old. The first electrical installation was made in 1887 by the Pennsylvania Railroad Company. In 1889 the Thomson-Houston Company installed a locomotive and a generating station in the Erie Colliery of the Hillside Coal & Iron Company. It is interesting to note that this locomotive was in service until 1911, or for a period of 22 years of continuous operation. The first electric pump installed was in 1890, and it has been in continuous operation ever since. From 1891 to the present year plant after plant has been installed in the mines and a gradual evolution has taken place.

## Details of Woolworth Tower Lighting.

With the first moment of the New Year 30 floors comprising the tower of the world's tallest building, the Woolworth Building in New York, burst from the black night a giant shaft of light crowned with a great scintillating jewel. Ever since the huge structure of 60 stories was erected it has been king of New York's skyline by day. At night, however, it lost itself in the darkness and the problem was to find some suitable means of properly lighting at night so as to bring to fullest splendor its architectural beauty.

Illuminated Tower of Woolworth Building.

It might as well be stated here that more light is provided for the illumination of the tower than is usually employed in lighting the streets of a city of 30,000 inhabitants. The total power required is 175 kilowatts. The installation required 50,000 feet of conduit of various sizes; 16,400 feet of cable; 50,000 feet of duplex wire; numerous auxiliary switches and at least two new lighting devices.

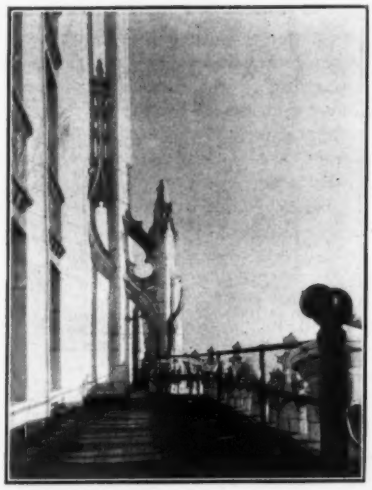
To transform a huge block of ma-

sonry 30 stories high into one great piece of uniform light takes more inventive genius than one imagines. Ordinary outline lighting was not desirable or feasible so that it was necessary, therefore, on account of the great height and to assure uniform lighting, that projectors—ordinary automobile lamps—be used. It took 600 of these projectors, each with a 250-watt lamp of the new gas-filled type, to play light upon the structure from the thirtieth to the fifty-eighth story.

These 600 projectors are so arranged that the rays from one set shoot upward along the sides of the tower and the space not illumined by them is played upon by another series of projectors arranged on the floors above which shoot their rays downward. Thus there is one continuous diffusion of light. Here, however, a serious problem was encountered, namely, how can the source of light which shoots downward be hidden? By a system of screening, however, the problem was solved and now anyone looking upward from the street to discover the source of light which comes down alongside the tower cannot detect it.

The following method of distributing the projectors was used: To light the West side of the tower a number of lights were placed on the North and South wings of the pent houses at the thirtieth floor. These lights shot their rays up as far as the forty-third floor. From the gabled roofs at the thirtieth floor projectors were placed which illumined the North and South sides of the tower as far as the forty-third floor. The East side of the tower had to be lighted from projectors placed on a narrow balcony opposite the twenty-seventh floor. All of these projectors were employed to shoot light upward, so at the forty-third floor a similar set of projectors was placed which shot their rays downward to bring into prominence any spot not touched by the lights from the thirtieth floor.

Looking upward from the forty-third and forty-ninth floors one can see lights focused up as far as the fifty-third floor, which is the beginning of the mansard roof. From this floor are more projectors which play upon the mansard roof. On the four tureiles opposite the fifty-fourth floor another series of projectors play upon the observation balcony at the fifty-eighth floor, which is just 750 feet above the pavement. The most novel feature of the installation is two stories above—the sixtieth story—which is called the crow's nest or lantern. It has been inclosed with diffusing glass and within there are placed over 20 powerful lamps totalling 45,000 candlepower. An automatic dimmer connected with these lamps continually alters their intensity in an irregular cycle. The glass surface of the lantern forms a deep red glow no brighter than the adjacent gilded structure and again it flares to a bright white light of fifty times this intensity.



Lighting the East Front From the Balcony at Twenty-seventh Floor.

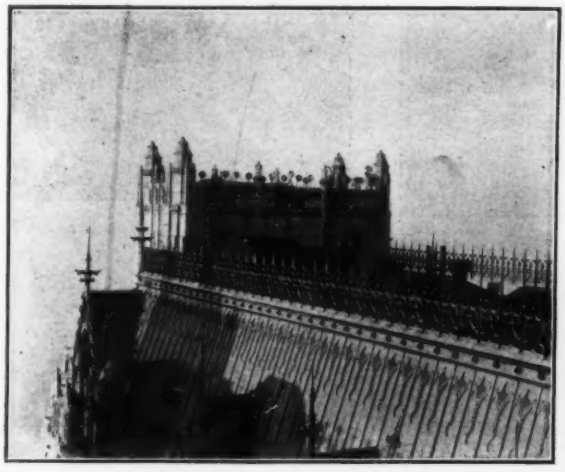
At a distance the tower appears a mighty shaft of light increasing in brightness with each higher section and preserving the main architectural lines until the observer is far away. A nearer view shows the marvelous detail of the building. The gilded surfaces of the mansard roof from the fifty-third to the fifty-eighth floors, the observation balcony, and the lantern structure above catch the rays from the projectors and come into radiant life.

They appear even more beautiful than in the afternoon sun. The reflecting characteristics of the glazed terra-cotta surface of the building and the necessity for mounting the large amount of equipment in a few restricted locations of the tower itself caused unusual difficulties in the design of the lighting scheme.

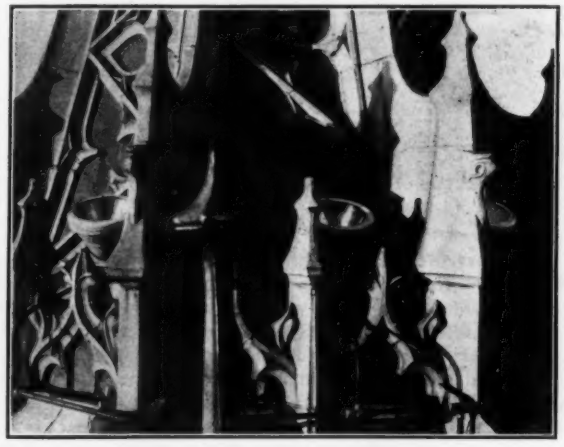
A working force of 40 men were busy for months making the installation, and on some days, when the wind was blowing a gale with the temperature just above the freezing point, it took no small amount of courage to place projectors on precipitous points over 700 feet above Broadway.

## Electric Cars in Norway.

Vice-Consul Dahr, stationed at Christiana, Norway, reports a good opportunity for the use of the electric car of every type in Norway. Road conditions are well adapted for this class of vehicle, and the electrical operating companies are disposed to co-operate with car owners both as regards facilities for charging and the establishment of a low rate. Incidentally, electric power plants are not far apart in Norway, and this renders it possible, says the Vice-Consul, for electric cars to travel all over Norway and be recharged whenever needful.



A Battery of Projectors.



Three Projectors at Close Range.

## Motor Drive in European Cement Works

Application of the electric drive for operating cement works has proved to be one of the difficult problems to carry out, and for this reason there has been less progress in this field of work than in many others. In this as well as in some of the other industries, the local conditions of manufacture are such that factory owners hesitate to abandon the steam engine in favor of the electric motor, and it remains for the engineer to solve such problems in a satisfactory way in order to widen the field of electric motor drive as much as possible. Present examples of European working show that considerable progress is being made in applying motors to this branch of industry.

In order to understand why such factories have been heretofore slow in adopting electric motor drive even though recognizing its general advantages, one must know the various kinds of work which the machines are called upon to carry out and when these are understood the reasons for retaining steam engines in the past will be better realized. The different figures for horsepower needed for each class of machine in the factory relate to works whose annual production is from 300,000 to 1,000,000 barrels of cement, counting the barrel at 380 pounds. This corresponds to a daily production of 140 to 480 tons. The various stages of manufacture may be classed under five general heads, and we observe the operations needed in each of these, estimated the corresponding amount of power needed.

*Preparation of Powder, Wet or dry.*—The raw material, which is almost always limestone and alumina, is crushed and mixed in the right proportions, which depends in each case upon the chemical composition. For a production of 300,000 to 1,000,000 barrels, this takes an amount of power ranging from 30 to 100 horsepower. The mixture is then ground by the dry or the wet process as the case may be, and is transformed to dry powder or thick mud. Fig. 1 shows a plant for this kind of grinding, with electric motor. The material is then loaded into silos or reservoirs and is well mixed up before going to the furnaces, this being done by means of mixing machines or more recently by blowing in compressed air. From 20 to 100 horsepower is needed here.

*Furnace Building.*—The above material goes through the rotating furnaces, which are drums some 130 to 240 feet long, driven at a slow rate of rotation (see Fig. 2), and the material is here dried and heated gradually, then baked so as to form the agglomerate (at about 1,500 degrees Centigrade.) A factory usually employs only 2 or 3 rotary furnaces. From 60 to 150 horsepower are here required. Next, the agglomerate is cooled in a set of cooling drums, which are seen in Fig. 2 undearneath the rotary furnaces. Such drums are also revolved by motors, and this takes from 30 to 90 horsepower. To keep up the heat in the rotary furnaces there is used an air-blast containing coal dust, and this takes 30 to 120 horsepower.

*Preparation of Coal.*—The coal, which is necessary for use in the furnace, is estimated at one-fourth to one-third of the total quantity of cement produced, or 50 to 120 tons of coal per day for the above production. It is dried, crushed and then ground so as to reduce it to dust, this requiring 80 to 120 horsepower.

*Cement Mills.*—The agglomerate coming from the drum furnaces in the shape of hard and irregular grains of blackish gray color and about the size of a walnut, is ground and transformed to cement in the grinding mills which are seen in Fig. 3, and is then transported to the cement silos. Three hundred to 1,200 horsepower is required here.

*Handling of Material.*—The handling of products or raw material as above noticed, such as cement powder or mud, agglomerate, coal and finished cement, require from 30 to 120 horsepower.

The above data enable us to have a good estimate of the total amount of power which a cement works requires, this being from 880 to 3,280 horsepower, and it will be seen that this class of works is one which uses a considerable amount of power for driving the various machines. A large part of the powder is taken by the grinding mills in the first and fourth stages of manufacture, the first for preparing crude powder or mud and the second mills for pulverizing the agglomerate to transform it to cement. It is for this reason that the steam engine of slow-speed type was once considered as the only proper source of supply for cement works. However, at the present time, the continual increase in production and consequent extension of factories are making the electric motor indispensible, and it has demonstrated its superiority in this industry over the steam engine with belt drive, as concerns economy, practical arrangement of the works as a whole, safety of employees, etc.

The best way to show the advantage of electric motor drive is to make a comparison of cement works with steam engine and factories using elec-

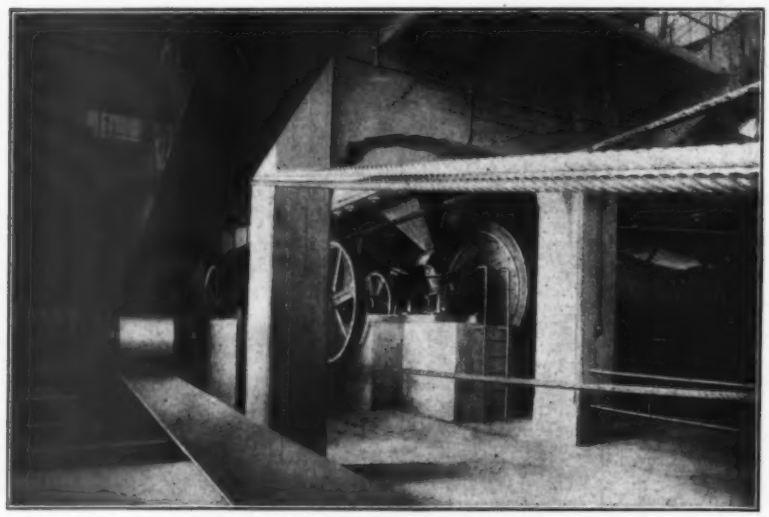


Fig. 1.—Motor-Driven Cement Grinder.

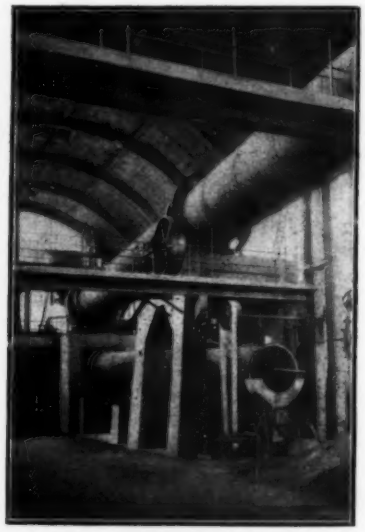


Fig. 2.—Rotary Furnace and Cooling Drum.

tric motors. Owing to the fact that the two sets of grinding mills already mentioned take each one-third of the total power, such mills, which practically represent the commencement and the end of the manufacture, are placed as near as possible to the engine house so as to reduce the belting, cables and other drive to a minimum. The other parts of the works are then connected as best may be with the main drive. The primary consideration in steam-engine driving is to use short transmission to the grinding mills, regardless of complication in the handling of materials in connection with the various processes of manufacture.

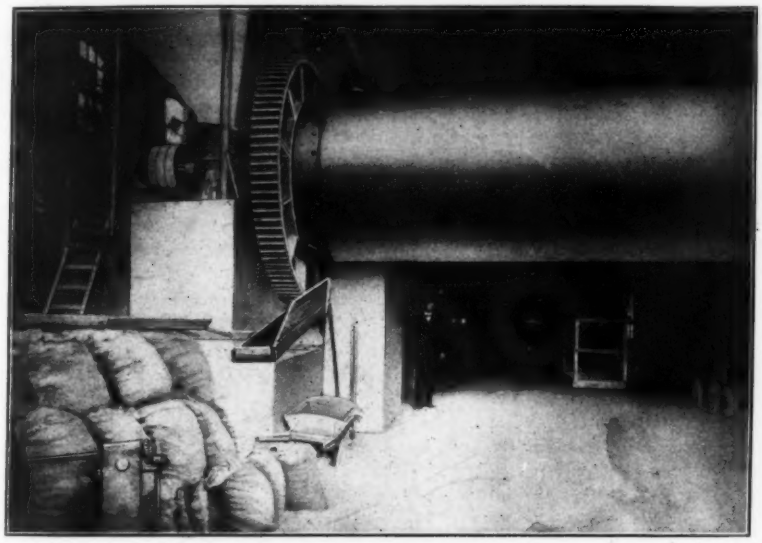


Fig. 3.—Tube Grinder for Cement.

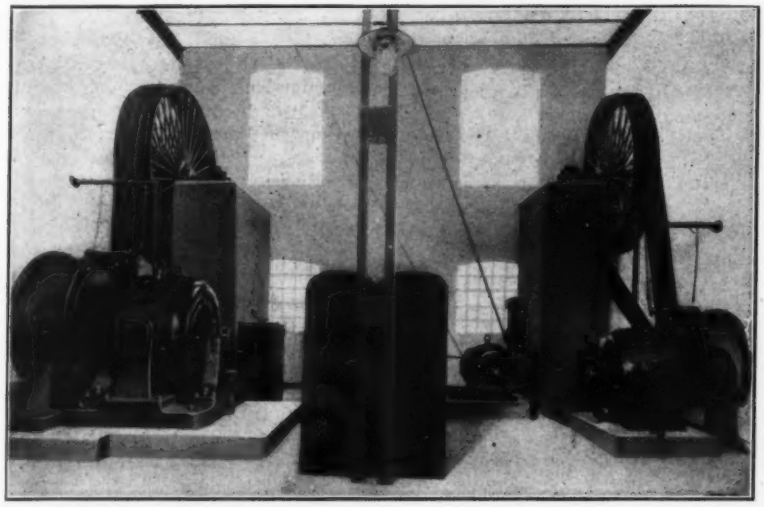


Fig. 4.—250-Horsepower Motor on Left Driving Grinder; 125-Horsepower Motor on Right Driving Tube Grinder; 50-Horsepower Motor in Middle Driving Conveyor.

In a modern cement plant using electric drive exclusively, the various machines may be arranged according to the order of the operations. The advantages are economy, a better and more rational layout of the premises and general good running of the plant. Economy comes from dimunition of losses in transmission, such as belts or cables, also lessening of upkeep expense and repairs, as well as expense for wages. In small factories up to 300,000 barrels, losses are about the same for steam or electric drive, but in large cement works the losses due to mechanical drive (cables, shafting, belts) are much greater on account of the great loss which comes in when running on light load or no load. Mechanical drive is at a still greater disadvantage when it is required to use several steam engines for the power, for this gives rise to added losses, either in steam piping in the case of a central boiler house or is shown in increase of general expenses when several sets of boilers have to be operated.

Electric drive allows of making all the work automatic from a mechanical standpoint, especially by the use of various kinds of electric conveyors for the material, so that the number of employees can be reduced. In mechanical drive, an extensive set of belts, cables, etc., means an increase in annual general expenses for upkeep and repairs, and shops often have to shut down for such reasons. All such expenses are much greater than in the case of electric drive. Another point is that the powerhouse can be placed at a distance from the factory at a place where it is operated under favorable conditions, and in laying out the plant no attention need be paid to the position of the powerhouse, the premises being disposed most favorably as regards railroad tracks, river and the like for the best handling of the material. Designing of new factories can be best carried out on the electric system, for at the start provision can be made for any future increase in the works by the addition of new grinding mills or rotary furnaces. Formerly the coal, agglomerate and sacks of cement were often handled in hand trucks, but where current is employed the use of electric motor trucks becomes quite an advantage for transporting the material. Owing to such improvement in handling the material, its accumulation in open quarters or sheds has now disappeared in the more recent factories which use electric drive, and in almost all cases there are only used stacks for coal, mud or raw powder, agglomerate or cement. All these improvements result in a much more satisfactory running of cement works, and a visit to one of the modern shops such as illustrated is quite striking in this respect. Working is also better with the electric motor because it is not required to stop the main engine and in consequence the whole factory in order to repair belts or cables. Belting which is still used with electric equipment does not make up great lengths, as in the former case, but is in the shape of distinct and independent groups which do not affect each other. Any trouble, which is in fact rare, is thus localized.

## Irrigation in Colorado.

Through arrangements made with the Arkansas Valley Railway, Light & Power Company, over 2,000 acres of land in Pueblo County, Colo., will be brought under cultivation for the first time. The land is exceedingly fertile, but it has been impossible to irrigate it. By the use of electrically driven pumps water will be lifted to the land and it is expected that with the extension of this system a much larger area will be cultivated.

## MISSOURI PUBLIC UTILITIES ASSOCIATION.

### Convention Cruise, May 27-30.

Following the precedent set last year by the very successful convention cruise of the Missouri Public Utilities Association, the convention held last week was an excursion on the Steamship *Quincy*. The steamer left St. Louis at 11 a. m. on Thursday with 125 members of the association and 75 ladies and guests. The course was down the Mississippi River to its junction with the Ohio, then part way up the Ohio and the Cumberland and Tennessee Rivers, returning by the same route and arriving at St. Louis on May 30.

Convention sessions were held in the cabin of the steamer, the first one being called by President A. C. Einstein, of St. Louis, at 3 p. m. on Thursday. Letters of regret at inability to be present were read from Governor Major of Missouri and T. M. Bradbury, secretary of the Missouri Public Service Commission. Mayor Henry W. Kiel of St. Louis, who was again a guest of the association, made a brief address recalling the very pleasant trip he had taken with his family on the convention cruise last year. Referring to public utility problems he called attention to the tendency to municipal ownership, much of which is due to prejudice.

President Einstein delivered a brief presidential address in which he first reviewed the history of the association. It had its first meeting in St. Louis on October 21, 1907, since which time the membership has steadily grown so that at the time of last week's convention the active membership was 148. He called attention to the objects of the association, which are primarily for the co-operative promotion of the interests of the utility companies of the state. One of the greatest problems in the utility business has been that of competition, particularly from municipal plants. Mr. Einstein showed that the public utility business is naturally a monopoly and gives the best results to a community when operated as a carefully managed monopoly. Therefore competition in this line is inadvisable. He concluded his address by pointing out the necessity for absolute confidence on the part of the public toward the utility company serving it.

A paper entitled "The Modern Public Utility—Its Attitude Toward the Community It Serves" was presented by H. C. Porter, of the St. Joseph Railway, Light, Heat & Power Company, St. Joseph, Mo. This paper showed that public utilities are considerably ahead of the public in the realization that co-operation is much more beneficial than competition. The modern idea of business and particularly of the utility business is service. The modern public utility has nothing to conceal. Utility men should acquaint the public with the newest and most advantageous ways of doing household and other daily work with the idea of reducing the drudgery of the routine labors of the day. In conclusion, he pointed out that although the cost of living has been going up the price of utility service has gone down. This paper was discussed by President Einstein.

### Electric Service for Small City.

J. P. Bowles, engineer of the Missouri Public Service Commission, Jefferson City, Mo., then presented a paper entitled "Electric Service for the Small City." He showed that in Missouri all but a very small percentage of the cities having in excess of 1,000 inhabitants are furnished with electric service, but that about 40 per cent of cities with from 500 to 1,000 inhabitants do not yet have this service. He discussed the way in which an electric plant for serving a city of about 750 inhabitants should be organized and erected.

First, it is necessary to make a thorough canvass of the community to find out approximately what number of customers can be obtained and about the number and size of lamps which they will require. Definite pledges should be secured along these lines; in making this canvass the estimated cost of wiring and equipping the premises with fixtures and lamps should be made clear. It should be possible to obtain well over 100 signatures through such a canvass. It is next necessary to secure from the authorities of the community a franchise, say, for 20 years, and a contract for street-lighting service for at least ten years. Unless street lighting can be secured it is almost out of the question to establish such a plant. In deciding as to whether all-night service should be given or only until midnight it is well to remember that the ability to turn on electric lamps by a touch of a button at any time of the night makes a strong argument in securing customers, otherwise oil lamps will be retained in more or less general use.

Mr. Bowles described a typical prospective plant for such a town. This was provide for about 30 street lamps bringing in a revenue of $525 per year. A good rate schedule for private customers would be 15 cents per kilowatt-hour for the first 20 kilowatt-hours, 13 cents per unit for the next 20 units and 11 cents per unit for all in excess of 40 kilowatt-hours; a 10 per cent discount should be allowed for payment within ten days; the minimum monthly charge should be $1. A simple flat-rate schedule could be worked out which in a case of a plant giving night service only would probably work out advantageously. Another system that could be used is one making use of a demand rate or a flat charge per watt connected, plus a low charge for energy as measured by meter. The average monthly consumption per customer for combined residence and business lighting should be at least 15 kilowatt-hours.

In selecting the plant and distribution equipment, an oil engine is doubtless best as the prime mover, and of the various methods of distribution the low voltage three-phase 60-cycle system of generation and distribution is probably best. The general details of the design were described by Mr. Bowles. The preferred units would be two 25-horsepower oil engines belted to two 15-kilovolt-ampere generators. These would be operated singly while the load was small, and together in parallel during time of heavy load. The total estimated first cost of the system was calculated to be $5,800, composed of $2,400 for engines and generators, $2,500 for distribution system, $300 for switchboard, $250 for land and $350 for building. The total energy delivered per year would probably amount to 24,000 kilowatt-hours. Services of a plant engineer could probably be obtained for $600 per year; fuel would amount to $256; lubricating oil, $75. Other expenses would bring the total cost to $1,720. Of the total receipts of $2,775 there would be a balance of about $1,050, or 18 per cent on the estimated investment.

By operating the plant in conjunction with a mill, machine shop, ice plant, waterworks, etc., a considerable reduction in operating and overhead costs would result. The practice of having customers pay for their service meters should be discouraged. The necessity for securing a large kilowatt-hour consumption per capita is very urgent. Among the possibilities is electric pumping for the city waterworks. In Missouri, of 123 utilities supplying water service, 42 are using electric pumping partly or entirely.

The paper was discussed by J. M. Scott, C. S. Ruffner, H. C. Porter, S. W. Henderson, G. E. Taylor, R. C. Russum, and Mr. Bowles. Mr. Ruffner discussed the subject of rates, advocating particularly the use of flat rates in a small plant of this type. Mr. Henderson thought that the first cost of such a plant would be nearer to $7,000. Mr. Hayler showed that while such towns can be very advantageously served from a general transmission system, there is considerable difficulty in getting sufficient business at first. However, local capital invested in a plant of this type can secure sufficient load to warrant connection to a transmission line later.

C. E. Brenton, of the Union Electric Light & Power Company, St. Louis, then presented a paper entitled, "Cost

of Service as a Basis for Rate Regulation." This paper reviewed the various theories that have been held respecting the calculation of the proper value in rate regulation. Citations were made from various commission and court decisions and from authorities on public utility regulation. In conclusion, the author showed that the reasonable value of the utility property should be measured by the cost of the economic service which it is capable of delivering. This is determined not alone by the examination and appraisal of the physical property, but also by the examination of the company's operating records. Reasonable value is not measured by the estimated reproduction cost or the cost of the physical property less depreciation, but by the cost of the investment and the cost of rendering the service, by the comparison of operating conditions and results of one plant with those of another and by considering all expenditures made, whether for investment or for operation.

On Friday morning the session opened with a paper entitled "By-Products of Gas Plants," which was presented by George S. Hessenbruch, engineer of the St. Louis County Gas Company, Webster Groves, Mo. This paper was discussed by Thomas D. Miller and V. L. Elbert.

A general discussion then took place on the subject of consumers' complaints, in which participated J. M. Scott, V. L. Elbert, H. W. Beck, H. Spoehrer, L. B. Landman, J. H. Van Brunt, F. D. Beardslee, and A. C. Einstein.

The afternoon session opened with a paper entitled "A Polylogy on Gas-Works Economies," by Thomas D. Miller of the Consolidated Coal Company, Chicago, Ill.

### Relations Between Utilities and Commission.

This was followed by a paper presented by J. H. Van Brunt, manager St. Joseph Railway, Light, Heat & Power Company, St. Joseph. The title of this paper was "Relations Between Our Association and the Public Service Commission." The author showed that Missouri utilities had long been the prey of unscrupulous and designing politicians. They had suffered from ruinous and unnecessary competition, the results of all of which have had to be borne by the public in the end. To correct these evils the Public Service Commission was created. The evils of competition in public utilities were pointed out and the manner in which this would be eliminated through utility regulation was made clear. Most utilities feel that since the creation of the Commission a new era has dawned for them. The Public Service Act has, as far as possible, removed the utilities from the dominating influences of local politics, prejudices and selfish interests and has placed them under the supervision of a non-partisan board composed of men with special qualifications by education and training for the duties devolving upon them. The relation between the Commission and utilities must be frank and mutually helpful. The utility companies must realize that they are quasi-public concerns. The Commission, on the other hand, should be mindful that these utilities have been promoted and financed by private capital which is entitled to a fair return. Co-operation between the utilities and the Commission should be carried out so as to extend and improve the service to the public, give greater security to the investors and greater prosperity to the utilities themselves.

### Financing of Utilities.

The final session was held Saturday afternoon and was opened by the pre-

George E. Hayler, Jr.,
President-elect, Missouri Association of Public Utilities.

sentation of a paper by C. F. Enright of St. Joseph. The title of this paper was "Financing and Valuation of Public Utilities." The business men of the community should be able to advise regarding utility investment. However, local interests, on account of lack of experience in this line, do not afford the best field for financing of public utilities. The people of Missouri communities also are unwilling to undertake their proportion of the financing of the utility, although later, after it has been established, they readily accept its securities at advanced prices. The men furnishing the initial capital and assuming the risk should be regarded as benefactors of the communities benefited. Insufficient encouragement is given to the backers of utilities. Lack of cordial support in the early stages often prevents the facilities of the utility from being extended. Commissions have shown a tendency to take care of the interests of the public only, largely due to a lack of proper understanding regarding their functions. Fairness and liberality toward the utilities is absolutely necessary, if a reasonable degree of public service by new utilities is to be secured. The commissions in dealing with the utilities should act as though the latter were owned by the state. There must be incentive for the company to make economies in construction and operation of the property possible. In many public service commission decisions important considerations aiming to protect the interests of the investor as well as the public have been overlooked. It should be realized that on establishing a utility the people are not compelled to become its customers; on the other hand, it is incumbent on the utility to serve all who seek its service. The promoters are therefore obliged to assume a very great risk until ample business has been secured.

An executive session ensued in which routine association matters were taken up. Reports were presented by the executive committee, secretary-treasurer, public affairs committee, committee on uniform rate schedule, workmen's compensation committee, progress committee, membership committee, legislative committee and entertainment committee. The suggestion, made on motion of V. L. Elbert, that the association name be changed to Missouri Association of Public Utilities, was adopted. In connection with the report of the workmen's compensation committee, an address was made by Senator S. E. Bronson in which he reviewed the situation that the Workmen's Compensation Act was designed to remedy. He also referred to the Public Service Commission and complimented the governor on the personnel he had selected for the commission.

The paper entitled "Power-Station Economics," was presented by E. J. Billings, results engineer of the Doherty Operating Company, at St. Joseph, Mo. This paper pointed out that many sources of loss and inefficiency are neglected in nearly every plant, attention to which will generally improve conditions. Good judgment must be exercised in deciding when to make replacements of inefficient equipment. Usually this is put off too long. Not enough attention is usually given to proper maintenance. Reports by operating men to superior officers calling attention to desirable improvements must show the monetary saving these will bring about. It is not generally realized that wasted coal, steam and heat represents wasted dollars and cents. Indicating and recording instruments should be liberally used to keep close check on the plant economy and general performance. The men in

the plant will generally reflect the policy of the management.

A talk on water purification was then made by E. E. Wall, water commissioner of the city of St. Louis, in which he described the system being installed by that city.

**"Jitneys."**

Philip G. Kealy, of the Metropolitan Street Railway Company, Kansas City, had prepared a paper entitled "Jitneys," which was read in his absence by Bruce Cameron, of St. Louis. In this the growth of jitney service in many parts of the country was reviewed. The cost of operating automobiles in this type of service was analyzed and it was shown that for small cars this approximates 10 cents a mile and 15 cents a mile for large cars. These operating expenses cannot be met by carrying passengers beyond a three-mile limit for 5 cents. The effects of jitney service on a community were pointed out. Participating in the discussion of this paper were L. B. Landman, Edward Smith, J. M. Scott, L. P. Andrews, George Hessenbruch and Bruce Cameron.

The convention sessions came to a close in the form of a brief executive session at which the report of the resolutions committee was presented by Mr. Hall. This thanked all those who had participated in making for the success of the convention.

**Election of Officers.**

The report of the nominating committee was then presented and the list of nominees for officers of the association for the ensuing year was unanimously elected as follows:

President, George E. Hayler, Jr., Joplin, Mo.

First vice-president, Hugo Wurdack, St. Louis.

Second vice-president, Bruce Cameron, St. Louis.

Third vice-president, J. H. Van Brunt, St. Joseph.

Secretary-treasurer, F. D. Beardslee, St. Louis.

Two new members to serve on the executive committee for two years, A. C. Einstein, St. Louis; L. P. Andrews, Sedalia.

Four new members of the public affairs committee to serve two years, V. L. Elbert, St. Joseph; H. C. Lewis, Caruthersville; P. J. Kealy, Kansas City; S. E. Roberts, Windsor.

President-elect Hayler, who is treasurer and general superintendent of the Empire District Electric Company, of Joplin, Mo., made a brief address thanking the association for the honor conferred on him.

Very liberal entertainment was provided throughout the trip. Included under this head was a series of guessing contests and card games for the ladies in which valuable prizes, chiefly electrical devices, were given. Thursday evening was devoted to a dance with cabaret features on board the boat. On Friday evening the steamer landed at Paducah, Ky., where a dance was given at the Country Club by the Paducah Light & Power Company. Early Saturday morning the steamer arrived at Cairo, Ill., where a tour of inspection of the city was made in private cars provided by the Cairo Electric & Traction Company, the trip being personally conducted by Mr. Crossley, general superintendent of the company. On Saturday evening a carnival was held on the boat. Among other features to enliven the trip were several boxing bouts between negro members of the crew.

## Classification of Technical Literature.

Delegates from about twenty national technical and scientific societies met in the Engineering Societies' Building, 29 West 39th Street, New York City, on May 21, to perfect a permanent organization, the purpose being to prepare a classification of the literature of applied science which might be generally accepted and adopted by these and other organizations.

There was a generally expressed opinion that such a classification, if properly prepared, might well serve as a basis for the filing of clippings, for cards in a card index, and for printed indexes; and that the publishers of technical periodicals might be induced to print against each important article the symbol of the appropriate class in this system, so that by clipping these articles a file might be easily made which would combine in one system these clippings, together with trade catalogues, maps, drawings, blue prints, photographs, pamphlets and letters classified by the same system.

By request, W. P. Cutter, the librarian of the Engineering Societies' Library and a delegate from the American Institute of Mining Engineers, read a paper on "The Classification of Applied Science" in which, after describing the existing classifications of one of which he is the author, stated that in his opinion no one of these, although having excellent features, was complete and satisfactory enough to be worthy of general adoption. He outlined a plan whereby a central office could collate all the existing classifications, and, with the help of specialists in the various national societies interested, might compile a general system, which although perhaps not absolutely perfect, might meet with general acceptance and adoption.

Permanent organization was effected by the election of the following officers: chairman, Fred R. Low; secretary, W. P. Cutter; executive committee, the above, with Edgar Marburg, H. W. Peck and Samuel Sheldon.

It was agreed that a special invitation to participate by the appointment of a delegate be sent to other national societies which might be interested in the general plan.

The following societies were represented by delegates: Samuel Sheldon, Library Board, United Engineering Society; Richard Moldenke, American Foundrymen's Association; C. Clifford Kuh, Society for Electrical Development; Cullen W. Parmelee, American Ceramic Society; Sullivan W. Jones, J. A. F. Cardiff, American Institute of Architects: George F. Weston, American Society of Agricultural Engineers; F. L. Pryor, American Society of Refrigerating Engineers; H. W. Peck, American Gas Institute; Nicholas Hill, American Water Works Association; Edwin J. Prindle, L. P. Alford, L. P. Breckenridge, American Society of Mechanical Engineers; F. J. T. Stewart, National Fire Protection Association; J. J. Blackmore, American Society of Heating and Ventilating Engineers; C. F. Clarkson, Society of Automobile Engineers; F. L. Bishop, Society for the Promotion of Engineering Education; George R. Olshausen, United States Bureau of Standards; E. C. Crittenden, American Physical Society; Alfred Rigling, Franklin Institute; W. P. Cutter, American Institute of Mining Engineers; Edgar Marburg, American Society for Testing Materials; A. S. McAllister, National Electric Light Association, American Electrochemical Society, and Illuminating Engineering Society; C. E. Lindsay, American Railway Engineering Association; G. W. Lee, Librarian.

The Executive Committee was charged with the task of enlarging the membership of the committee to include delegates from all similar national organizations, and the preparation of a plan for further action.

The delegates present expressed most hearty and enthusiastic personal interest in any system which might be worthy of general adoption. They could, of course, not promise at this early date anything more than moral support to the idea, reserving for themselves and for their societies the right thoroughly to examine any system that might be evolved before recommending its adoption.

The name adopted for this organization is Joint Committee on Classification of Technical Literature, and the temporary address of the secretary, W. P. Cutter, is 29 West Thirty-ninth Street, New York City.

**During the month of April, 190 housewiring permits were issued by the city of Stockton, Cal., compared with 116 in April, 1914.**

## The Utilities Indemnity Exchange —Reciprocal Liability Insurance for Utilities and Other Electrical Interests.

Much attention has been given in recent years to a nation-wide safety movement aiming to reduce to the lowest possible minimum the number of accidents to workmen and to the public generally. At the same time increasing attention has been directed to reducing to a minimum the suffering and damage due to the accidents which still unavoidably occur. An outgrowth of this is the series of workmen's compensation laws now in force in most of our states, as a result of which employers have had to give careful consideration to liability insurance.

In the case of utility companies liability insurance is needed not only for protecting them against accidents to employees but also to their customers and the public in general. This caused this matter to be a fertile topic of discussion in meetings of utility associations, which brought out the fact that the rates for this service charged by the stock liability insurance companies were very high due to heavy overhead expenses. The possibility of reducing this cost was gone into carefully and it was found that by co-operation among utility companies this end could be achieved through reciprocal or inter-insurance, a form of mutual protection that has proven very successful, although naturally strongly opposed by the old stock insurance companies. This led to the establishment of the Utilities Indemnity Exchange, which has specialized in the handling of liability insurance for utility companies, particularly electric light, power and telephone companies.

The Utilities Indemnity Exchange was opened in December, 1911, and since that time has taken over the care of the liability insurance of a steadily increasing number of corporate and individual operators of utility plants, who constitute its membership and who have found that in this co-operative manner they have been able to reduce the cost of their liability insurance by 40 per cent on the average.

The Exchange operates on the most approved inter-insurance plan. To cover all contingencies, the members deposit with the Exchange each month approximately the regular rates charged by stock companies. Out of this fund are paid the losses, legal expenses and management costs, the latter limited to 30 per cent. The unexpended balance reverts to the members at the end of the year; this has averaged in excess of 40 per cent of the deposits or what might be termed insurance premiums. To guard against unusually heavy losses that would involve expenditures in excess of the total deposits, the usual plan of re-insurance is followed, that is, all losses that would exceed the total deposited are assumed by approved re-insuring companies, thus guaranteeing that the cost of the insurance will never exceed that in stock companies, although it actually works out very much less, as mentioned above.

The aim of the Utilities Indemnity Exchange has been consistently to take care of the best interests of its members. Thus, legitimate claims are paid promptly and cheerfully, instead of being fought in drawn-out litigation that uses up the funds in legal and court costs, a policy followed too frequently in the past with resultant engendering of ill will among the employees toward the utility. All parties have been given complete satisfaction, except in a very few cases, where arbitrary and unjustified claims had been made on the employer. Not only has the Exchange not evaded liability to any of its members, but, on the contrary, it has frequently followed a more liberal interpretation of its policy obligations than technically required.

The Utilities Indemnity Exchange is located in the Railway Exchange Building, St. Louis, Mo. Its attorney and manager is Lynton T. Block, a man experienced in liability insurance, who has conducted the business for the members in a broad-minded manner. Mr. Block has appeared before many associations of utility and electrical men and clearly but modestly pointed out to them how they may save materially on their liability insurance through this co-operative plan.

Among the associations that recently, after careful investigation, have indorsed the plan heartily are the National Independent Telephone Association, the Iowa Electrical Contractors' Association, and the Electrical Contractors' Association of the State of Illinois. The latter association has made a study of liability insurance for a year or so and found that a further saving could be effected through the medium of the Utilities Indemnity Exchange over its own mutual liability plan. Other prominent electrical organizations, including one of national scope, are contemplating indorsement of the Exchange to their members.

The finances of the Utilities Indemnity Exchange and its general control are entrusted to an advisory board composed of the following from among the members of the Exchange: A. C. Einstein, vice-president and general manager Union Electric Light & Power Company, St. Louis, Mo.; Hugo Wurdack, president The Light & Development Company, St. Louis, Mo.; J. J. Frey, president Southern Illinois Electric Light & Power Company, Hillsboro, Ill.; F. J. Postel, utility operator and consulting engineer Millers' Mutual Fire Insurance Companies, Chicago, Ill.; D. L. Gaskill, president Greenville Electric Light & Power Company, and secretary Ohio Electric Light Association and National District Heating Association, Greenville, O.; Manford Savage, president Home Telephone Company, Champaign, Ill.; C. B. Cheadle, operator of eleven telephone companies in Illinois and Iowa, Joliet, Ill.

## Ultra-Violet Rays from the Oscillating Spark.

The quartz-inclosed mercury-vapor arc, which first rendered practicable the application of ultra-violet rays to such services as the sterilization of water, has now a rival in the oscillating spark which, according to J. Kowalski, forms under certain conditions a more economical source of ultra-violet rays. Working on an industrial scale with a step-up transformer feeding the oscillating circuit (which comprises a battery of condensers, self-induction and spark-gap paralleled across the condensers and discharging the oscillating circuit at intervals), it is claimed that water sterilization requires no more than 45 to 90 watt-hours per 1,000 gallons treated. Laboratory tests show from 200 to 400 watt-hours per 1,000 gallons to be necessary for complete sterilization, but water treated in practice is less infected than laboratory samples, and conditions generally are more favorable to rapid sterilization.

The wave-length of maximum radiation from the oscillating spark is displaced towards the ultra-violet as the amplitude of the oscillating current is increased and as the spark is more strongly damped (i. e., as the energy expenditure in the spark increases). In order to increase the amplitude of the current, the capacity of the oscillating circuit must be as great and the inductance as small as possible. There is a risk, however, of increasing inductance as well, if it be sought to provide large capacity by using a great number of condensers. There is a certain value of $\sqrt{CL}$ (corresponding to the wave-length of current produced in the oscillating circuit) which should not be exceeded for best radiation efficiency.

The material of the electrodes is an important factor and should be such as to give maximum damping. Ultra-violet radiation between electrodes of invar, aluminum, brass, zinc and copper is found to be proportional to the numbers 128, 99, 85, 78 and 73. The frequency of sparking is also important, the ultra-violet intensity from a 22-millimeter gap between invar electrodes being proportional to 2, 1.6, 1.3 and 1.0 with 20, 30, 40 and 50 sparks per second respectively.

The percentage distribution of radiation horizontally in the direction of the axis of a 110-volt Heraeus lamp, operating at 90 volts, 3.1 amperes, is given thus: Heat, 24 per cent; visible, 41 per cent; ultra-violet, 35 per cent. The radiation from a 22-millimeter invar gap, operated at 30 sparks per second,

with 50.5 amperes in the oscillating circuit, is analyzed, by the same method, as follows: Heat, 22 per cent; visible, 18.6 per cent; ultra-violet, 59.4 per cent. These figures show the oscillating spark to be 70 per cent richer than the mercury arc in ultra-violet radiations. The spark gains a considerable initial advantage in that it can be produced directly in the water to be treated, without the necessity for the quartz envelope, which absorbs up to 20 per cent of the ultra-violet radiations from a high-pressure mercury arc, and those, moreover, which have the greatest sterilizing value.

To meet industrial requirements for a simple instrument determining the ultra-violet radiations of any source, Prof. Kowalski utilizes the property possessed by ultra-violet rays of decomposing levulose (and certain other carbohydrates) to liberate carbonic oxide. The beam to be tested is simply passed through the windows of a small closed vessel containing levulose and connected to a mercury-filled capillary tube which indicates the amount of gas liberated, and so, subject to a temperature correction, the intensity of the ultra-violet radiations.—*La Revue Electrique.*

## Nickel-Plating Aluminum.

The difficulty of electroplating aluminum with nickel lies not in devising a suitable electrochemical process but in securing a coherent deposit. An intermediate coating has generally been considered indispensable between aluminium and nickel, and copper, zinc and iron have been proposed and tried in various ways. In the first place, however, a chemically clean surface must be secured on the aluminum, and to the well known difficulty of obtaining this must be attributed failure to secure a deposit which will stand mechanical working.

A new process, described by Canac and Tasilly before the Société d'Encouragement pour l'Industrie Nationale, is claimed to overcome this defect. The aluminum piece to be plated is passed first through a boiling potash bath, then brushed with milk of lime, dipped in a 0.2-per-cent potassium cyanide bath for several minutes, and finally subjected to attack by an iron-chloride solution (500 grams hydrochloric acid, 500 grams water, 2 grams iron), till the appearance of the aluminum resembles crystallized tinplate. After each stage in this treatment the work is thoroughly washed in water. The following is found to be a satisfactory nickeling solution: Water, 1,000 cubic centimeters; nickel chloride, 50 grams; boric acid, 20 grams, worked at 2.5 volts and 1 ampere per square decimeter. The deposit obtained is matt-grey on leaving the bath, but easily takes a good coating under the scratch brush. Above all, it is claimed that the coating will stand bending and hammering without peeling or cracking. The reason for the adherence of the deposit appears to lie in the strong reducing action of the nascent hydrogen evolved when the aluminum is plunged in the ferric-chloride pickle. Metallic iron is deposited on the aluminum, and, though its amount is so small (0.25 to 0.5 gram per square meter), that it cannot form a continuous intermediate deposit, the iron forms with the aluminum a number of tiny couples favoring attack by the acid pickle. The surface of the aluminum is thus very minutely but very completely pitted so that, besides being deposited on the nearest practicable approach to a chemically pure surface, the nickel coating is actually locked or rooted into every part of the aluminum surface, and it is on this mechanical action that the tenacity of the deposit depends.

Aluminum thus protected is said to be unaffected by moist air, dilute and boiling soda, acetic acid, sea salt, wines, and foodstuffs, and does not permit leakage of gasoline. It is recommended as useful for electrical conductors, and is claimed to extend greatly the possible applications of aluminum.—*Electrical Review* (London).

## Lead Poisoning in Manufacture of Storage Batteries.

The Bureau of Labor Statistics of the Department of Labor, Washington, D. C., has just published in its Bulletin No. 165 (obtainable free on application to the Bureau) the results of an investigation of storage-battery plants in the United States, made by Dr. A. Hamilton, with special reference to the causes and prevalence of lead poisoning in the industry. The measures for safeguarding workers adopted by Great Britain, Germany, and France are also given.

In the United States there are five large factories making lead storage batteries, one in Ohio, two in New York, and two in Pennsylvania. A great many smaller plants, employing from 5 to 15 men each, are scattered about the country. This investigation dealt principally with the five large plants.

In making the lead plates or grids the worker is exposed to the dusts of the metallic lead and to its fumes when melted. By using hoods and exhausts over kettles and by keeping the work places strictly clean, these dangers can be much reduced. Making and applying the paste involve handling lead oxides, which is much more dangerous than handling metallic lead. The oxides must first be mixed, which is a very dusty job, and then made into paste. Both these operations can be done by machinery under cover, thereby greatly reducing the danger to the worker. In most of the plants visited, however, either such protection was not furnished or it was used so carelessly that it was of comparatively little effect.

In the processes which follow the pasting, such as assembling the plates, lead burning, etc., the worker is exposed to danger from lead fumes and from dust from the dried oxide pastes.

The dangers of the industry can be reduced to a minimum by installing hoods and exhausts to carry off fumes and dusts, by substituting machine for hand work, by providing ample washing facilities for the workmen and insisting on strict cleanliness everywhere, and by providing a separate lunch room as the only place where food may be kept and eaten.

The cases of lead poisoning found in storage-battery work are usually acute, with colic and, in severe cases, encephalopathy, but not paralysis. The severer forms of plumbism are not common. Among 64 cases studied 12.5 per cent were classed as severe, 39 per cent as moderate, and 48.4 per cent as mild. The period of exposure was not usually long. Of 60 cases studied, six had been exposed less than one month, 31 less than three months, and 50 less than six months.

In comparison with Germany and Great Britain the storage-battery industry in this country makes a bad showing as to sanitation. In the largest German factory the rate of lead poisoning is less than 1 per 100 employees, and in Great Britain it is about 3 per 100. In the five largest factories here the rate, based on reports known to be incomplete, is almost 18 per 100.

## Northern States Power Company To Sell Stock in Home Territory.

Northern States Power Company, which composes one of the larger utility systems managed by H. M. Byllesby & Company, is making arrangements to encourage investment in its seven-per-cent preferred stock by residents of Minneapolis, St. Paul, Mankato, Faribault, Fargo, Grand Forks, Sioux Falls and other cities where service is rendered the public.

Although there is no new stock being issued, in all of these cities the preferred stock will shortly be obtainable, both through local financial institutions and direct from the operating company. To bring the subject to the attention of the public and customers, resident managers will explain the plan in circular letters, and newspaper advertising will be employed.

# Commercial Practice
# Management, Rates, New Business

### Stockton Street Lighting.

The Western States Gas & Electric Company, Stockton, Cal., has completed the installation of 249 electroliers in Stockton, 157 of which are paid for by the city, and 92 by property owners and tenants. A considerable additional number will be installed later for property owners. There are at present 612 Novalux street lights of 600 candlepower installed in the city, and a street light is installed on practically every corner of the city which is even fairly well built up.

### Artistic Lamp Exhibit.

Reference was made in the issue of May 22 to the lamp exhibit which was arranged by the New York Edison Company and took place in its show rooms at Irving Place and Forty-second Street, New York City, May 15 to 30. Twenty-one manufacturers contributed to the collection, which included altogether about 150 types of lamp. These were not selected with an idea of displaying the most expensive products of the manufacturers but included lamps ranging in price all the way from $6.00 to $250. The accompanying illustrations show two views of the show rooms while this display was in progress.

### Contract for Railroad Shops.

Muskogee Gas & Electric Company has secured the contract from the Missouri, Oklahoma & Gulf Railroad Company to furnish 650 horsepower of electric energy for the new railroad shops being built at Muskogee.

### Fan Campaign of Texas Power & Light Company.

The Texas Power & Light Company this year conducted a special fan campaign in all of the cities in which it operates, in co-operation with electrical contractors and dealers. To every electric consumer in the towns in question a little sheet was sent as shown in Fig. 1. This called attention to a series of advertisements which were placed in the daily papers.

Introducing

Mr. Kool-husband

Who has discovered that summer is fast approaching.

Watch Daily Papers for further experiences of this interesting character.

Fig. 1.—Sheet Sent to Consumers.

The plan of the whole campaign was to feature Mr. "Kool-Husband" and Mrs. "Kool-Wife" two fictitious characters. The campaign started by showing Mr. Kool-Husband look at a thermometer and feeling the need of a fan. The second piece of advertising included the first cartoon and in addition showed Mr. Kool-Husband passing in front of an electric shop where he saw some fans. The third piece of copy included the first two cartoons and in addition a third showing Mr. Kool-Husband sweltering in his office. The next showed him going into an electrical shop and purchasing an elec-

General View of Lamp Display.

Center Table in Showroom.

tric fan. He was next shown in his office enjoying the refreshing breezes. The series was continued by bringing his wife into the limelight, showing her in a hot kitchen and afterwards in her husband's office, in the electric shop and in her sitting room. The sent to each electrical contractor and dealer in each of the towns and it was pointed out that to get full benefit from the advertising it would be to their advantage to carry local advertising of their own, asking the newspapers to run their copy on the same play and where possible to make the display a moving one. For instance, instead of a stationary fan in the window it is better to use one with ribbons fluttering, as this secures much more attention from the passing public.

WHEW! GOING UP
ELECTRIC SHOP
ELECTRICAL SUPPLIES
The Result Is Pleasing
Mr. Kool-husband finds that a penny spent in operating a fan is a good investment when judged by the increased work he is able to do..
TEXAS POWER & LIGHT COMPANY
No. 81-5

Fig. 2.—Fifth Advertisement in Fan Campaign.

ELECTRICAL SUPPLIES
The Contented Kool-family
Is there any reason why your family should not be just as comfortable when the cost of comfort is so low See your electrical dealer today
TEXAS POWER & LIGHT COMPANY
No. 81-9

Fig. 3.—Ninth Advertisement.

successive pieces of copy are shown in Figs. 2 and 3. The most important part of the campaign was the fact that each advertisement contained cartoons of all the advertisements previously used, thus building up the interest and inducing people to watch for the series.

An announcement of the plans was page as that of the central-station copy.

The offer was also made to contractors to supply suggestions for fan copy to be used in these local advertisements. This service was rendered without charge. It was also suggested that the advertising be accompanied with an appropriate fan window dis-

The final element in the campaign was the sending out each week of bulletins in the shape of a telegram and bearing a heading "New Business Co-Operative Letter-Gram," accompanied by a zigzag lightning stroke. These bulletins gave figures for the number of fans connected in the various towns for each week.

# Electrical Construction

## BUSINESS HINTS FOR DEALER AND CONTRACTOR.

By G. D. Crain, Jr.

### Specialization Pays.

Specialization in salesmanship is usually the most effective plan. The man who is doing one thing, studying one thing, selling one thing, can present his proposition in a way the customer cannot resist. On the other hand, the solicitor whose ideas and energy are spread out over a large line is not able to handle each with the "punch" provided by the specialist.

One large concern, which handles contracting in addition to the sale of electrical merchandise, has three men on the street. One devotes his attention to wiring exclusively. He doesn't pay any attention to the fixture end of the business at all. The concern has a fixture expert who handles this field, featuring at present sales on a well advertised specialty for which the firm recently secured the agency. The third specialist is giving his entire time and attention to sales of rectifiers, demand from garage owners and motion-picture-theater operators having proved sufficient to give him all that he needs to do to keep busy.

"We find that by having men who are specialists in these various lines," said the head of the company, "the customer gets better service, and we handle the business with the least possible friction. It works well all around."

### Following Up the Inquiries.

Manufacturers of electrical goods are doing so much advertising of a constructive, convincing kind that they are receiving thousands of inquiries for their goods from consumers. These inquiries are distributed among the dealers who are handling their products in the various communities.

Illustrating the number that are being produced, one representative dealer received five in one day recently, and the number was not out of the ordinary.

"We have found these inquiries very valuable," he said. "They sometimes come from people who inquire out of curiosity, but in most cases the inquiry means business. We follow them up promptly, most of them being disposed of the same day they are received. We have a man with an automobile, much of whose time is taken up with the pursuit of inquiries given us by the manufacturers. They lead to business as a rule, but the important thing is to handle them before they get 'cold.' The customer who wrote in asking for information will have lost interest if you delay getting to him too long."

### Co-operating on "Shorts."

"No customer ever goes out of our store without getting what he came for," said a successful electrical dealer.

He went on to explain that while his stock is of course not absolutely complete, he has an arrangement with a number of other retailers, whereby each of them uses the others' stocks when the occasion arises.

"If somebody comes in and calls for an article we don't carry, or which happens to be out of stock at the time," he said, "we telephone to one of the other stores and locate the item. Then we send for it, or notify the customer that it will be delivered, and thus show that we are able and willing to supply anything in the way of electrical goods.

"The merchandise handled in this way is billed to us at the regular retail price, less 10 per cent. This gives us a chance to handle the item, since we have practically no overhead on it, and at the same time the other fellow gets his share of the profit.

"Our bills with other electrical stores, and theirs with us, often run to $40 or $50 a month, showing the extent to which this feature is made use of. It is a very valuable bit of co-operation, I can assure you.

"The calls which we receive are of course made note of, and if we find that there is a good demand for a line which we have not put in stock, we proceed to carry it."

### Service to Motor Users.

The electric motor is not absolutely trouble-proof, though compared with most mechanical appliances it is very free from anything of that sort. Now and then, however, a unit will be put out of commission, and then it is up to the dealer to take care of the customer in the best possible fashion.

This consists in many cities of replacing the motor which is being repaired with another of the same capacity, so that the work of the user may go on without any delay. This is a development of service which makes it necessary for the dealer to carry a stock of motors sufficiently varied to take care of the needs of his customers in this respect, but it also demonstrates the complete convenience and great advantage of using electric power. The consumer who, in spite of a disabled motor, is able to go ahead in short order with another, supplied and put in place by the dealer, is bound to be a booster for electric power; for, if his steam plant got out of fix, or any of his mechanical transmission equipment went wrong, he would be compelled to suffer loss and irritation by reason of his consequent inability to operate.

### Clean Up After Wiring Jobs.

A good way to make money is to clean up thoroughly after every wiring job. Perhaps the better way to put it would be to say that this is a good way to avoid losing money. Of course, where the contractor is handling work on a percentage basis, the loss of material falls on the owner, but it is bad business from any standpoint to be wasteful in this respect.

A contractor who has a representative business, as to size, recently pointed to the $400 runabout which his city solicitor is using in his work.

"I bought that with the money I got for the copper I have been accumulating," he explained. "Our men have to turn in all of the scraps and odds and ends from every job. The insulation is burned off and the scrap wire piled. Owing to copper having been pretty low, I have been holding it, and had accumulated several thousand pounds when I decided to sell recently, in view of the attractive prices being quoted. The automobile is the result."

Is there any better evidence of the desirability of carrying out the clean-up policy?

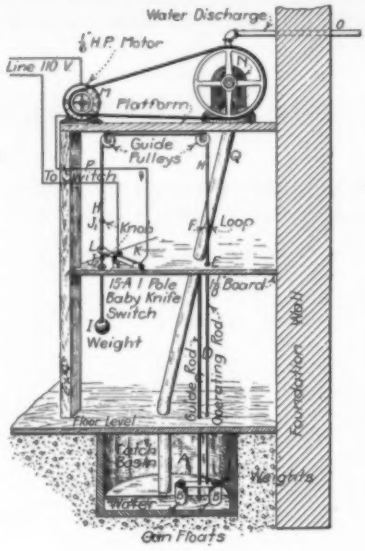
### Departmentizing the Stock.

One of the best plans the electrical merchant can use is that of departmentizing his stock, so that his daily sales will show from what sections of the stock the business is coming. This will be of advantage in a number of ways. It will show what kind of merchandise is proving most popular, and will also suggest the sorts that need stimulation in some way.

Where a cash register is in use, it is possible to develop this information without any difficulty, as most of the registers have attachments for indicating the origin of the sale, as to the

department, as well as the salesman handling the transaction. If no register is being used, the sales slip made out by the clerk could easily indicate the required information. The department could be shown by number or letter, the latter probably being the most convenient way.

Departmentizing plans would vary with the store. That with a large stock would probably find it necessary to make its groupings rather inclusive, while the dealer handling comparatively few lines would be able to go into more detail. Fans would of course be a separate section of almost any store, while electric signs would also come under its own head. Separation of the numerous lines of novelties would be harder to make. Washing-machines would be important enough for a separate department, but curling irons, percolators, flash-lights, etc., might all be grouped together under one general head.




Automatic Pump Control.

## An Automatic Pumping Equipment.

The installation here described was installed for pumping water occasionally out of a cellar where the floor was arranged to drain into a catch basin, A. In this catch basin two water-tight cans, B, B, were fastened to a vertical rod, D, which connected with a cord running over two pulleys and supporting a weight, I. When the water lifts these floats in the catch basin, the weight I will descend and the knob, $J^3$, on the cord, will close the knife switch K. This closes the circuit through the motor and starts the pump in operation. When sufficient water has been pumped out and the floats have been lowered sufficiently to bring the knob, $J^3$, up to the handle, L, of the switch, the switch will be opened and the motor stopped. The motor is belted to the driving wheel of the pump, N. Q is a pipe connecting the catch basin with the pump and O, the discharge pump leading outside.

This equipment has been in operation for a year and has not given any difficulty, which is evidence of its practicability.

F. J. Vevia.

## ELECTRIC ELEVATORS, OPERATION AND MAINTENANCE.—III.

By A. C. Bender.

### Automatic Electric Elevators.

In apartment buildings or places where an elevator is required only at long intervals, the automatic elevator can be used to good advantage and with economy. In essential features it is the same as other types of drum elevators. The novel part of this elevator is its control.

A push-button is located at each floor for controlling the direction of the car, and in the car is a series of push-buttons, one button to each floor, and one extra button named the Stop Button. This button when pushed will bring the car to a dead stop irrespective of having pushed a starting button.

When operating the car the passenger wanting to use same pushes button at

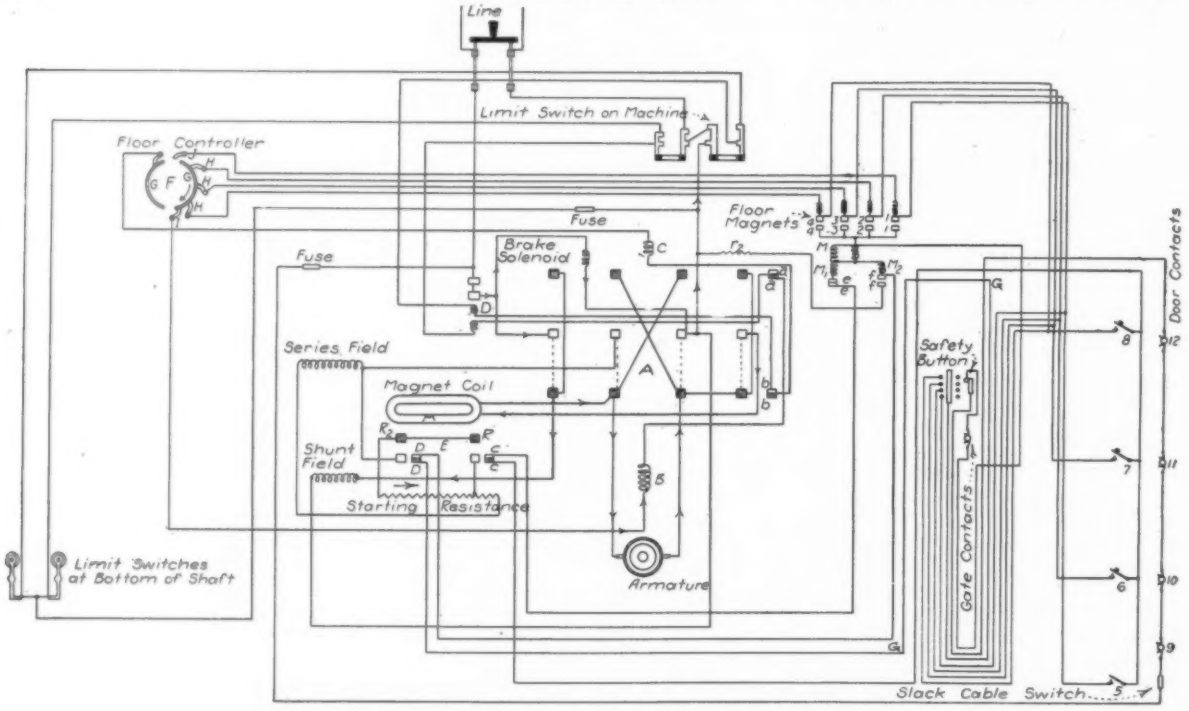



Fig. 21.—Wiring Diagram for Otis Automatic Elevator.

landing, the car will then start automatically and stop on the floor the button was pressed on, and unlock the door. The passenger can now run the car, after closing the door, by pressing the button marked with the floor desired.

The automatic elevator is made safe with open-door switches, limit switches, etc. The open-door switch prevents the car from running should any door in the shaft remain open, or if any one is getting on or off the car.

Automatic elevators have a magnet controller board, similar in many respects to a car-controlled machine. They are

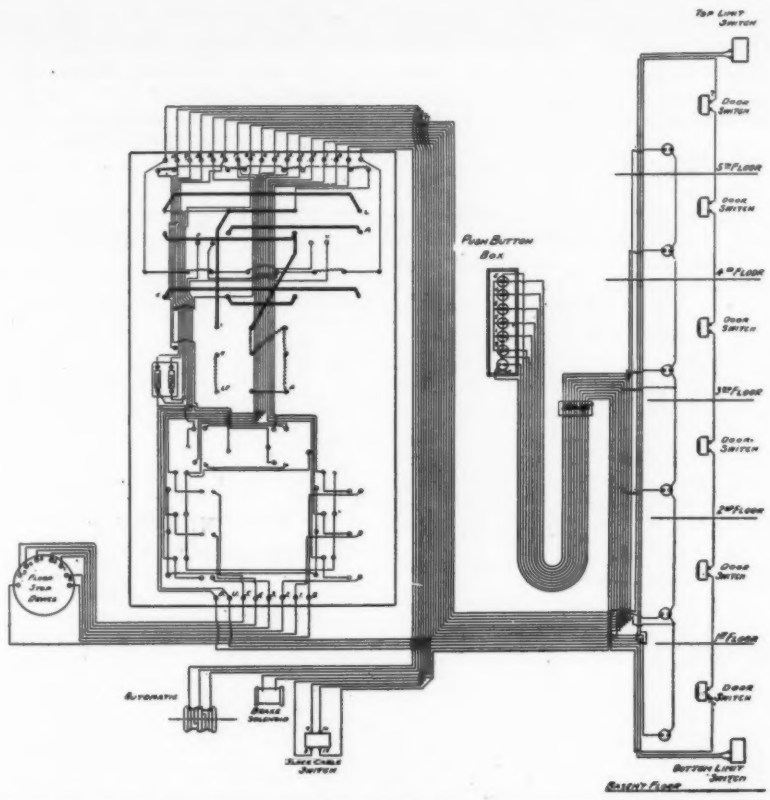



Fig. 22.—Wiring Diagram for Push-Button-Control Elevator with Non-Interference Switch.

arranged with floor magnets that are energized by pushing the button either in the car or on a landing. This action closes the circuit on starting current and brakes, and automatically remains closed until car reaches its destination or is stopped by the stop button.

Fig. 21 is a wiring diagram of an Otis automatic elevator. Considerable improvements have been made in late years in the design of automatic elevators, but the working principles are the same.

The electrical operation can be traced out in the wiring diagram by starting at the main direction switch A. When the magnet coil B is energized, the switch is pulled towards B and makes connection with the lower contact as indicated by dotted lines, assuming now that the car moves up when magnet coil B is energized and down when C is energized.

Switch D closes the main circuit. 1, 2, 3, 4 are the small floor magnets; 5, 6, 7, 8 are the push buttons at each floor; and 9, 10, 11; 12 are door contacts. As will be seen, these contacts are connected in series and are connected together as shown only when all of the doors of the shaft are closed. Should a door open, the circuit is broken and it is impossible to start the car.

At E are shown two switches for cutting out the resistance and the series-field coils that operate by magnet M. F is the floor controller driven from the winding drum. Assuming the car is going up, the controller will turn in the direction of the arrow and contact G slides from under H, H, H, and I in proper order. At the same time contact G is coming in contact with J, H, H.

When switch A is pulled by coil C, contact is broken between the auxiliary contacts a, a, thus opening the circuit through coil B. Also when A is operated by coil B, contact is broken between contacts b, b, thus opening the circuit through coil B. Also when A is operated by coil B, contact is broken between contacts b, b, thus opening the circuit through coil C.

It is now impossible for both B and C to be excited at the same time. When switch E makes contact at R, contact is broken between c and c. When contact is made at $R_2$, contact is broken between D and D.

When the armature of magnet $M_1$ is drawn up, contact is broken between points e, e. When the armature of $M_2$ is attracted, contact is made between points f, f. When magnets 1, 2, 3, 4 operate, contact is made between 4 and 4, 3 and 3, etc. When buttons 1, 2, 3 or 4 are pressed, contact is made between wire G and the wire running to the floor magnet corresponding to the button that has been pressed.

In Fig. 23 is shown wiring diagram of an alternating-current six-floor combination car switch and push-button-control elevator manufactured by Kaestner & Hecht Company. This car can be used as a push-button elevator or controlled from car only. Car switch will be seen in the diagram so connected.

Fig. 22 is a wiring diagram of a six-floor push-button-control elevator with

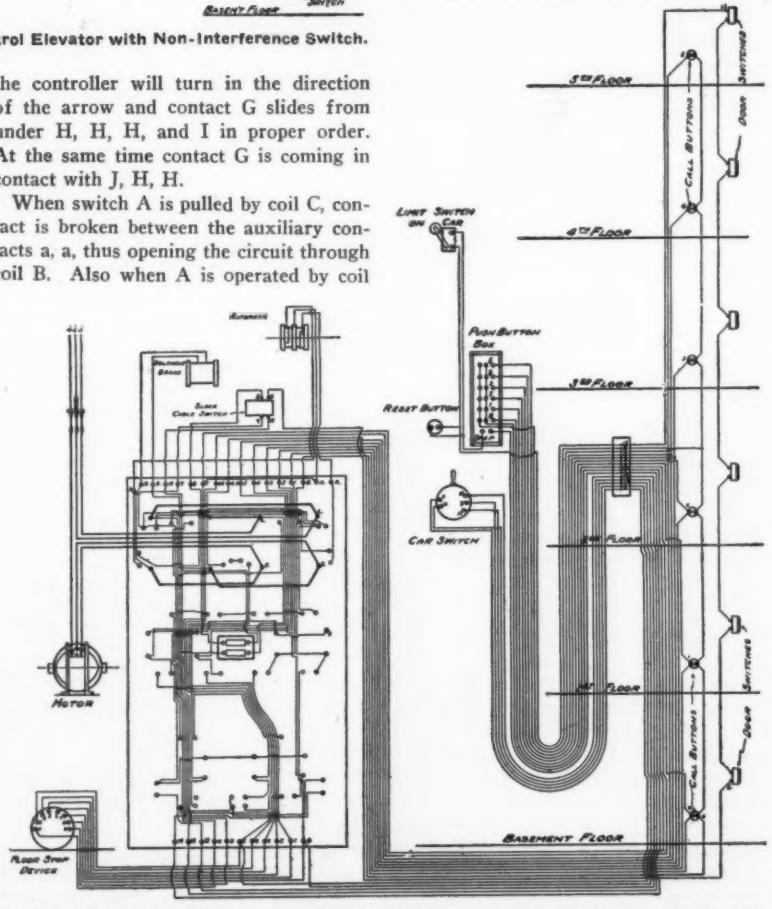



Fig. 23.—Wiring Diagram for Alternating-Current Elevator with Combination Car Switch and Push-Button Control.

non-interference switch. On this type of machine controlling magnets are mounted on front of board and are not shown here.

### Unique Fixture Display.

The N. C. Pickard Electric Company, 1323 Grand Avenue, Kansas City, Mo., has a clever advertising device in connection with the show window that strikes the eyes of many thousand people every day. Grand Avenue is a main thoroughfare, and street-car passengers, as well as pedestrians, see this display feature—they can't help seeing it, for it is moving—a moving platform bearing electrical devices visible through a small opening in a white glazed-brick sill. Those who pass along the sidewalk can see into the window and through another opening, in the floor of the display window, down upon the moving platform.

This platform is about ten feet in diameter, and circular, situated under the floor of the display window and on a level with the sidewalk. It is pivoted, and kept revolving by means of a small motor. It has a larger area for the display of electrical apparatus and lighting equipment—and a spectator watching the sill orifice a moment can see all of it. Larger articles are displayed on the usual window floor. The motor keeps the moving platform or wheel, as it is locally called, in motion until 10 o'clock at night; the cost of operation does not exceed 15 cents a day.

Last winter this company completed the equipment of its display rooms, of which there are four: One for office equipment, one finished in mahogany with white ceiling for semi-indirect lighting fixtures; one in green, for modcrate-priced fixtures and glassware, one in oak for cheaper fixtures. All the ceiling, bracket and portable fixtures are equipped with lamps, and there are lamps under all the articles of glassware. In the case of the fixtures each has its own switch by which it may be lighted seperately; the portables are lighted in groups, according to prices; the glassware is lighted by switches illuminating a shelf at a time. In the middle of each room is a table bearing a switchbox; in each switchbox is a series of sockets for testing lamps. The plan of the display, as well as the scheme of lighting, was devised by Mr. Pickard, and the switchboxes were made in the shop.

Exterior of N. C. Pickard Store.

Display Room with Table and Switch Box.

### Among the Contractors.

Announcement has been made that the Speilman & Baker Electric Company, of Butler, Pa., has dissolved, John A. Baker, junior member of the firm, retiring. W. G. Speilman will now be the sole owner of the firm, which will be known as the Speilman Electric Company. The concern is well known in western Pennsylvania.

The Harry I .Wood Company, Louisville, Ky., has been awarded the contract for installing the electrical equipment in the new plant of the Columbia Sanitary Manufacturing Company, which will make plumbers' supplies and plumbing fixtures. There will be a total of 30 high candlepower lamps and seven motors.

Seymour Taylor, Glens Falls, N. Y., has received contracts for furnishing and installing complete electric lighting plants, including engine, generator and storage battery in the following: C. H. Bogle's hotel, at Schroon Lake; Owl's Head Inn, Keene; Trout House, Hague; G. A. Rogers, Friends Lake; Henry Goldman, Upper Saranac; camp for Hugh McCulloch, Assembly Point; wiring three cottages, Sabbath Day Point House, Lake George.

The name of the West Side Electric Company, Omaha, Neb., has been changed but the constitution of the company remains the same. The firm will hereafter be known as Thew & Luhr. The business will be conducted at 110 North Fifteenth Street. The president and manager of the company is H. H. Thew, the vice-president and secretary is W. E. Luhr, and the treasurer is M. L. Thew.

Thomas McGoey, 100 North Third Street, Grand Forks, N. D., on May 15 bought out his former partner, E. J. Bennie, and will continue alone in his general construction business. Mr. McGoey does all kinds of electrical repairing and handles a full line of supplies. He has also an official service station for the Willard Storage Battery Company.

### Illinois Electrical Contractors' Meeting Postponed.

The semi-annual meeting of the Electrical Contractors' Association of Illinois has been postponed from the date previously announced, and will be held in Peoria, June 25 and 26. The Peoria contractors are making extensive preparations for this meeting, and a profitable time is looked forward to.

In addition to these business meetings there will be a ball game between the contractors and the supply men on Saturday afternoon, while the customary banquet will be held Saturday evening. Entertainment will be provided for on Friday night, the exact nature of which has not been announced.

### Kansas Contractors Elect Officers.

The Kansas Electrical Contractors' Association held its annual meeting at Topeka, Kans., on May 22. The following officers were elected: I. C. Bushong, Ottawa, president; J. A. Mercer, Topeka, vice-president; R. N. Sutton, Wichita, secretary; H. S. Lee, Topeka, treasurer. The next meeting will be held in Kansas City, Mo., on July 10.

# Public Service Commissions

Conducted by William J. Norton

## IDAHO.

**The Lewiston-Clarkston Improvement Company.** The application of the company for permission to depart from the rules laid down by the Commission with regard to overhead-line construction was denied. The company had purchased a supply of cross arms which did not conform to the code promulgated by the Commission and asked to be allowed to use them.

## MAINE.

**The Penobscot Bay Electric Company** was authorized to issue its first-mortgage five-per-cent gold bonds, due January 1, 1929, to the amount of $21,000, to be sold at not less than 90 per cent of their par value and accumulated interest. An issue of common stock, to the amount of $9,300, was also authorized to be sold at not less than par.

In the Black Stream Electric Company case (reported in ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, May 22, 1915, page 955), the Commission stated that it is not in favor of authorizing new corporations to issue stock at less than par. Criticisms arising from misunderstandings regarding the effect of this decision have reached the Commission, and in its decision in the Penobscot Bay case a further explanation of its policy affecting the issue of stocks and bonds is given. The following is an extract from that explanation:

"There is a well defined distinction between the issue of common stock and of bonds. The former is an evidence of the relative ownership of certain individuals in an enterprise. It carries with it no promise to pay anything except a pro rata division of the net earnings, and, in case of liquidation, of the net assets of the corporation. The certificate means to the inexperienced just what it recites on its face—that the holder has invested in the plant so much money, and that the plant has been enriched to that extent. It is safer for it to mean the same thing to all persons. If a corporation is promoted for legitimate business, as this one appears to have been, nothing is gained by certifying that a person who has actually paid less than one hundred dollars into the treasury has paid in full for one-hundred-dollar certificates. If it is promoted for stock-selling purposes, such a certificate may aid in imposition upon the public. We believe that in the long run this policy will secure the best results.

"On the other hand, a bond, like a promissory note, is a promise to pay a certain sum of money at a certain time with interest at a fixed rate. At whatever price it is sold the amount of the debt and the value of the owner's interest is definitely fixed. In practice it makes little difference whether its rate is four per cent or six per cent. It is bought and sold on the basis of what it will actually earn during its life, at its fixed rate, on the money paid for it. Its price must always depend upon the current rate of money for similar investments."

**Moosehead Telephone and Telegraph Company.** The Commission has authorized the New England Telephone and Telegraph Company, the Northern Maine Telephone and Telegraph Company, and the Moosehead Telephone Company, three companies operating in what is known as the "Moosehead region," to effect a consolidation under the Moosehead Telephone and Telegraph Company. The latter company is a new corporation formed for the purpose of acquiring these properties and serving the region through one organization. The Commission found that the patrons of the three existing companies were not and could not be adequately served by the companies operating separately, and that the proposed consolidation under the new management is reasonable, desirable and necessary in the interests of the public.

A valuation was made to determine the reproduction cost of the properties to be used in determining the present value. In the case of the New England Telephone & Telegraph Company its plant and properties had been kept up to date, so that the element of obsolescence and inadequacy did not materially decrease the present value below the reproduction cost. In the cases of the Northern Maine Telephone & Telegraph Company and the Moosehead Telephone Company obsolescence and inadequacy reduced the reproduction cost about 18 per cent, and this was necessary on account of the manner in which the lines of each of these companies were originally built, the failure to make necessary repairs and the failure of each company to keep its plant and equipment up to date, resulting in the necessity of expending a considerable amount of new money in bringing each of these plants to a condition where proper service could be given.

The Moosehead Telephone & Telegraph Company was authorized to issue its capital stock to the amount of $170,200, the exact amount required for the purchase of the franchises and properties of the three companies, as fixed by the engineer, and as agreed to by the selling companies.

## MASSACHUSETTS.

**Marlborough Electric Company.** The Massachusetts Board of Gas and Electric Light Commissioners has issued a decision fixing the maximum price for electricity sold by the Marlborough Electric Company. Petitions were received asking for a reduction in the company's rate for commercial lighting in Marlborough, Northborough Southborough, Westborough and Berlin. A valuation was made by an engineer for the city of Marlborough. The decision says: "The theory advanced by the city practically conceded that the cost of the property, which is useful and efficient, for the prosecution of the company's business, under existing conditions is a controlling factor in determining the rate. But it also claimed that no allowance should be made for property which has been superseded by a permanent arrangement for the purchase of electricity from outside sources, on the ground that had there been a wise administration of the company's affairs these losses would have been anticipated and provided for. In the absence of evidence of mismanagement or dishonesty the Board believes that under the long established policy of the Commonwealth all the paid-up capital honestly and prudently invested should, under normal conditions, be recognized in determining what is a fair rate, but it does not follow, however, that idle capital is to be on the same footing as the active. The Board distrusts a valuation as a decisive test of investment where actual cost of the property and the circumstances under which it was acquired can be ascertained. It is also of the opinion that one of the important functions of depreciation, beside taking care of the daily wear and tear, is the anticipation of changes in the art, and in the possible intervening conditions, which, although they may have little or no relation to the useful life of the physical

property, yet cannot ordinarily be foreseen. It realizes, however, that a prudent management cannot always have provided fully for changes of this character, and especially in the first stages of the industry, or in a case like this, where the business of the earlier years was not profitable. It believes that a proposition to allow the right of the investment to a return, but to disallow in any substantial measure the obligation to keep it good, is not consistent or sound. Applied to this case the views which the Board has expressed do not result in a conclusion as to the allowable return so different in amount from the claim made by the city as appreciably to affect a finding as to price. But the Board does believe that, under all circumstances, sufficient emphasis was not given to the need of a more adequate provision for depreciation."

The city's engineer had allowed 7-per-cent return on the original cost, and a 3.5-per-cent allowance for depreciation on the present value. The same engineer found that the maximum price was too high and might be reduced to 10 cents and the secondary and other charges omitted.

The Board discussed the situation as to rates as follows: "For a number of years the company has employed the so-called 'demand' system in its charges for electricity, both for light and power. In the consideration of this case, however, it seems only necessary to consider the prices for commercial lighting. For a certain number of hours' use a month of the lighting consumer's demand, varying with the month, but aggregating 520 hours a year—known in the schedule as 'primary usage'—the rate is 15 cents a kilowatt-hour. For all electricity consumed a month in excess of this amount the rate is 12 cents a kilowatt-hour. Where the customer guarantees a use of not less than four hundred of his demand a year, the rate for 'primary usage' is 20 and for 'secondary usage' 6 cents a kilowatt-hour. The 'primary usage' under this yearly guarantee consists of a certain specified use of the customer's demand a month, which varies with the month, but aggregates 400 hours a year. The demand is defined as 'the greatest amount of electricity used by the customer at any one time,' and, until automatically determined by the reading of a demand indicator, it is estimated by the company, in no case, however, at less than 108 watts. After an indicator is installed the demand is established by its highest reading during the months of November, December and January, for each year, beginning February 1. As a matter of fact, the company has few, if any, of such demand indicators installed on the premises of its customers, and the demand is estimated at one-third of the customer's connected load, assuming each lamp socket to be the equivalent of 50 watts. In the application of the rate for guaranteed use of the demand the latter is ordinarily determined in each case by observation of the number of lamps normally lighted at any one time.

"The Board's finding relates to the maximum net price at which electricity may reasonably be required to be sold for any use. It may be proper to say, however, that the method which this company employs for applying the 'demand system' is so crude and liable to abuse as to lack such merit as is ordinarily urged in favor of this system. It is believed that if the company is to continue to offer differentials, whether for light or power, the whole schedule may well be overhauled."

The Board recommends that the price for electricity supplied by the company for any use shall not exceed 12 cents a kilowatt-hour, on and after June 1, 1915.

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## WISCONSIN.

**Appleton Municipal Water Utility.** The city of Appleton applied for a revision of its water rates, and a petition was also filed by private consumers, alleging that the city did not bear its fair share of the cost of the service, but that a portion of the costs of fire protection and service to public buildings is borne by the private consumers. The Commission discussed the proper business relationship between the city and its water utility, as follows:

"It is held by some that inasmuch as the city has in the past paid interest on bonds and retired certain bonds during the period the plant has been owned by the municipality, these amounts so expended were in lieu of hydrant rental or fire protection payment. Amounts advanced by the city of Appleton for the retirement of water works bonds go to increase the city's equity in the plant upon which it is entitled to a return. The interest on the water works bonds, on the other hand, under the scheme of retiring $5,000 of bonds each year, is decreasing. If this interest is to be considered as payment for fire protection service it is at once seen that the payment will be decreasing each year. . . .

"While the city of Appleton generally may be liable for the water works bonds this liability should be considered as guarantor only for the payment of interest when due. The interest itself should be met out of the water revenue, as was done during the last two fiscal periods, revenues from private consumers having been about sufficient to meet operating expenses and interest charges on bonds then outstanding. If the city of Appleton generally desires to increase its proprietary interest or equity, it can do so by retiring the bonds they come due, out of the General Fund. As the bonds are bought by the City General Fund the amount of issue will decrease and the equity increase. The interest payment, however, should always be met, as far as practicable, out of the revenues of the plant, derived from both general service and fire protection service, and not as at present, from the general service revenue alone. . . .

"A great many cities with municipal plants, Appleton included, fail to recognize the commercial nature of their water business, as distinguishing it from the general city departments, and as a result such city generally feels that it need not pay for service rendered by the plant. It can be readily seen that this is not the correct attitude. At the very best a city with a municipal plant must consider the water department a separate and distinct business enterprise in which the city generally and the water department should be in much the same relationship as exists between the city and private concerns with which it deals."

In the valuation of the property of a municipal utility the Commission holds that an amount should be added to operating expenses for interest taxes and depreciation. "This Commission has held that a municipal corporation is entitled to a return upon the investment the same as in the case of a private corporation, but cities are often satisfied with a somewhat lower rate, in order to give the consumer some advantage in taking service from such a plant. The city pays 4.5 per cent interest on the bonds issued to cover the water plant. In the succeeding calculations we shall assume a rate of return of 4.5 per cent on the plant investment. . . .

"It is not customary in a municipal plant actually to assess taxes against the plant, but if such items as taxes and interest are not considered in fixing rates for private consumers, it would seem that these consumers would be favored as against the taxpayers. In others words, every factor must be considered in calculating a schedule of rates for a municipal plant, that properly enters into the cost of furnishing water, so that the water user and not the taxpayer will pay the cost of furnishing water."

The members of the Commission's staff making the investigation reported that it was almost impossible to secure necessary information, because of lack of records. The Commission says:

"This confirms that the failure of the city of Appleton to comply with the law, and the repeated request of this Commission and provide and install a proper system of accounts for its water works render efficient operation and the determination of the cost of the plant very difficult."

No allowance has been made for depreciation. The Commission states that even upon the portions of the plant recently installed depreciation must be recognized. "This larger part of the distribution system, etc., has been installed for a considerable period and depreciation has been going on continually during this time. While a new plant will not show a depreciated condition shortly after its construction such provision for depreciation is very sure to become necessary sooner or later through one cause or another.

"Such earnings as were obtained in excess of direct operating expenses, ordinary maintenance and taxes were apparently applied to make returns upon the invested capital or were reinvested, as new capital. Had a depreciation reserve been kept by the utility from the beginning it is obvious that such annual reservations would have correspondingly decreased the net earnings of the utility and increased any deficit which may have occurred.

"The effect of including in the cost new the large recent investments in property, against which little depreciation can yet be considered to have accrued, will obviously be to increase the ratio between present value and cost new. The difference between these values, theoretically, at least, should be in the assets offsetting the depreciation reserve, in order to preserve the property and the investment represented by it.

"When it is necessary to compute depreciation the rate should be determined upon the basis of cost new and the composite life of the property to be depreciated."

In the valuation of the property of the water utility, the question of allowing for discarded property was discussed as follows: "As the discarded equipment is no longer used or useful for service under ordinary conditions, it should probably be eliminated from the valuation for rate making purposes. The statute limits the scope of the investigation to ascertaining the value of the active property of the utility. Sec. 1797M—3, Ch. 499, laws of 1907.

"This Commission has previously discussed the question of non-operating or discarded property:

" 'When such non-operating property is held by a utility, the only warrant for its retention is expected savings and additional net income. This being the case, an addition to the physical value of the plant for non-operating property can be justified for rate making purposes only when the income expected therefrom is added to the actual income or is deducted from operating expenses. Therefore, whether or not this non-operating equipment may profitably be kept on hand, is a matter which need not be passed upon for the purposes of this case; the relative economy of holding non-operating property as against purchases at such time as the equipment in question may be needed, is a matter concerning which the management must use its own judgment. The simplest equitable method would be, it seems, not to consider these investments in the determination of rates.' In re Appl. La Crosse Gas & Electric Company, 1911, 8 W. R. C. R. 138, 164.

"In view of the facts disclosed by our analysis in this case, it appears that an allowance of about $1,240 per year for amortization of investment in non-operating property will be equitable under the circumstances. This will allow the investment to be wiped out in about thirty years on a four-per-cent sinking-fund basis."

**The Colfax Telephone Exchange** asked for authority to increase residence rates from $1.00 to $1.50, the rate for business service. The Commission says: "Although the total revenues to be produced by the proposed changes would not increase the company's return to the point of unreasonableness, we believe that a proper distinction between residence and business service would hardly warrant the establishment of the same rate for single party residence service as for single party business service, although there is no question that a higher rate for single party residence service than for two, three or four-party residence service is justifiable. We believe that a rate of $1.25 per month for single party residence service should be authorized in this case."

The company also proposed to put in effect a rate of $2.00 per month where service is maintained for less than one year, with a charge of $2.00 for installing and $2.00 for disconnecting the telephone. The decision says: "That some addition to regular rates should be made in the case of short time service would appear to be unquestionable, but the amount proposed by the company appears to be unnecessarily greater than the rates on a yearly contract basis. It may be that there are local conditions which would justify the rate suggested by the utility for short time service, but if there are such conditions the Commission has not been apprised of their existence. Therefore, we believe that in establishing a short time rate we should be guided in a general way by the practice in other places. If the charge for service on a short time basis be fixed at 50 per cent in excess of the charge for service on yearly contract basis, with a provision that the minimum charge shall be the charge for three months' service, we think the company will be fully protected without placing any unreasonable burden upon short time users. It will be a reasonable requirement to insist that short time users pay their charges in advance and that unless paid in advance before the 10th of the month the company may discontinue service."

The Commission also authorized the company to put in effect a charge of $1.50 for changing the location of telephones.

**The Morris Telephone Company** was authorized to increase its rates for telephone service, in the town of Morris, Shawano County. The Commission states that the rates formerly in effect were too low to enable the company to permanently furnish good service without endangering its financial condition, but that with the adoption of the new rate schedule, there will be no reason for exempting the company from compliance with the general rules for service.

A similar order was issued upon the application of the Cameron Farmers' Telephone Company for authority to increase rates in the village of Cameron. The policy of the company with regard to expenditures had been very conservative, and the opinion says "it seems evident that proper operation and maintenance to give even a reasonable standard of service cannot be permanently carried on on as economical a basis as has heretofore existed."

## Federal Employment Offices.

The United States Government, through the Department of Labor, has inaugurated as a part of the Division of Information a country-wide employment bureau. It is the belief of those connected with the work that it will go far toward improving business conditions in the United States. The underlying principle of the work is, perhaps, best expressed by the Secretary of the Department of Labor in the following words:

"The Department of Labor . . . has . . . established distribution branches throughout the country for the purpose on the one hand of developing the welfare of the wage earners of the United States and improving their opportunities for profitable employment, and on the other hand of affording to employers a method whereby they may make application for such help as they need, either male or female, citizens or alien residents, and have their wants supplied through said distribution branches."

Comparative statistics show that there has been in some portions of the United States a surplus of labor, while in other portions a deficiency. It is believed that this condition will be almost, if not entirely, eliminated by this work.

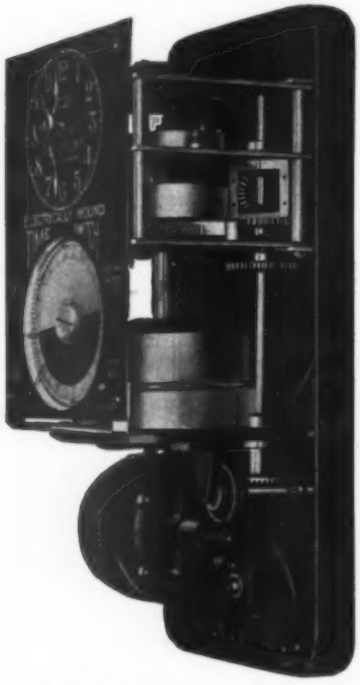
The United States has been divided into eighteen sections, or distribution zones, and in each of these an employment office has been opened.

# New Electrical and Mechanical Appliances

## An Electrically Wound Time Switch.

One of the things that has retarded the more general use of time switches has been the necessity for periodically winding the clock mechanism controlling them. Depending on whether the clock used was a one-day or eight-day timepiece, it has been necessary to give regular attention to this feature either every day or every week.

To overcome this disadvantage there has been placed on the market an electrically wound time switch in which are also embodied other interesting features. This device has a specially built clock mechanism which was designed to meet the requirements for this time switch. No clock element available on the market was found satisfactory and of sufficient ruggedness to meet the conditions. The distinctive element in this clock is the very rugged escapement which was especially built for the purpose. This is of substantial construction and is accurately balanced so as to withstand the hard service at extreme temperature changes. The escapement is made in a unit mounted on the top plate of the clock where it can be replaced, should this be necessary, without removing any part of the clock itself or the switch. The clock is built with heavy gears and pinions. The shafts of the escapement are vertical so as to reduce friction to a minimum.



Electrically Wound Time Switch.

Very heavy springs are used in the clock and these are kept fully wound at all times. As the springs run down they close the contacts for a small electric motor which rewinds the springs through a set of differential gears. By this means the springs are regularly wound to even tension. As soon as the springs are wound to this point the motor is automatically stopped. The springs have sufficient power so that they will continue running the clock mechanism for a long period after the supply of current to the motor might be interrupted. Should the power be off, the contact for the winding motor is left closed so that when the supply is restored the motor immediately starts up and winds the springs to a normal tension. In normal operation the electric winding of the clock consumes about three minutes every four hours. No solenoids are involved in the winding or in the control of the motor.

The switch mechanism is operated separately from the clock, so that no load is imposed on the timing mechanism. A special tripping device is provided for releasing the switch with the minimum possible friction. This is controlled through a set of gears from the clock springs; this was an additional reason for making the latter powerful. The switch is of the rotary snap type and, by the selection of the proper type of switch, a great variety of combinations can be obtained. Thus the switch can control one, two or three circuits of either two-wire or three-wire type and these can be operated independently or together in various combinations. Switch operations are not restricted to turning circuits on and off once each day but the switch may be operated as frequently as conditions require.

These switches in the standard size have a capacity up to 35 amperes at any voltage up to 250. Switches of larger capacities and for higher voltages are specially built to meet requirements. They are suitable for controlling automatically any circuit up to their capacity. The cover of the switch is dustproof and waterproof; by removing it all parts of the mechanism are immediately accessible. All parts of the clock and switch are white-nickeled. This with the fine exterior finish makes the outfit of attractive appearance. Operation being entirely automatic, so that it is merely necessary to inspect and oil the equipment twice a year, makes these devices suitable for a great many more services than the ordinary hand-wound time switch.

These switches are manufactured by the Minerallac Electric Company, 400 South Hoyne Avenue, Chicago, Ill.

## Benjamin Semi-Direct Lighting Unit.

A simple but effective lighting unit of the so-called semi-indirect type has just been announced by the Benjamin Electric Manufacturing Company, 128 South Sangamon Street, Chicago, Ill.

The construction of this fixture is at once apparent from the illustration herewith, which shows it equipped with the conventional canopy and brass chain. The ventilating hood and six-inch holder are of brass, and support a sixteen-inch opal-glass reflecting dome, while suspended below the lamp is an opal-glass bowl eight inches in diameter, which operates to diffuse the direct light from the lamp, spreading the glaring unbroken rays of light that dazzle and injure the eye.

New Semi-Direct Fixture.

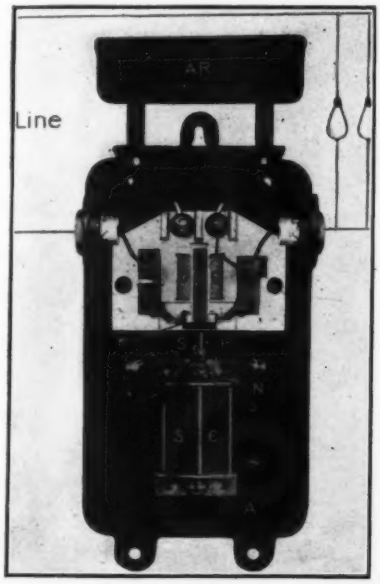
Benjamin porcelain sockets are furnished with this fixture in either me-

dium or mogul base. These sockets have an added feature in the Benjamin lamp grip, which effectively prevents the lamp from loosening through the most severe vibration. Altogether the new Benjamin unit is an attractive fixture and one in which marked attention has been given to efficiency.

## A New Flickering and Dimming Excess Indicator.

The increasing popularity of the controlled flat rate for very small customers on central-station lines has brought with it a demand for new types of controlling instruments.

The Pittsburgh Electric Specialties Company, Pittsburgh, Pa., has recently perfected and placed on the market a new flickering and dimming excess indicator to meet the demand for an instrument that will cut into the circuit automatically and reduce the current supply below the adjusted load when-




Flickering and Dimming Excess Indicator With Cover Removed.

ever an attempt is made to use a flat-iron or other large-current-consuming device, whether the lamps are in circuit or not.

This instrument operates on the same principle as the well known flickering excess indicator, by causing the lamps to flicker whenever an overload of lamps is placed on the circuit, and, in addition to this, it is provided with a dimming resistance which cuts into the circuit automatically as soon as an iron is placed on the circuit. It reduces the current flow in the circuit to less than eight-tenths of an empere, so that there is less than 80 watts flowing in a 110-volt circuit.

This auxiliary resistance *AR* is mounted at the top and prevents the heating of an iron under any conditions of service or length of time. At the same time it relieves the instrument of any strain due to unnecessary operation of movable parts.

These instruments are made for use on both 110-volt and 220-volt circuits—alternating current or direct current. Broad patents covering this new feature have been granted. The detail of construction is shown in the accompanying illustration, which also shows how easily the outfit is connected in series in the circuit.

While numerous tests that have been made have proved conclusively that successful ironing cannot be done where the current is intermittently impressed on the iron, as is done by the indicator that flickers only, this improved type of indicator will appeal to central-station men who have held the belief that flickering instruments, when subjected to overloads, such as is due to the use of an electric iron, would ultimately break down, due to the wear and tear incident to the operation of the working parts.

## The Electrograph.

The Electrograph is an apparatus recently developed for communicating any desired message to a crowd of people, inside of buildings or halls or in the open air. This is done by means of light flashes on a field or bank of electric lamps, certain groups of lamps being lighted momentarily to form letters of a word or words, which are visible in succession and form the sentence desired. The device is a development of the electric sign flasher, employing a similar principle of operation, but being more compact and adaptable to a large number of uses for which the present so-called "talking signs" are scarcely available because of their high first cost and expensive operation and maintenance.

The Electrograph "talks" graphically and automatically any desired number of sentences before repeating them. Its word-flashes are easily read and produce a most effective result. The apparatus is furnished in many sizes and styles, from the small window-display attraction up to the largest open-air or roof sign. The outfit is intended for publicity in general, as a medium for individual and collective advertising, as an indicator or annunciator of news items, information, commands, etc.

The machinery controlling the device, being light and small, requires but little floor space and can be placed anywhere near the lamp-letter-field or lamp-bank, and may be concealed in various ways. The lamp-bank where the messages are made visible can be with or without display in order to conform to the conditions surrounding the space where it is used. Thus it can form part of a more or less elaborate sign, or be entirely independent. The text or messages to be transmitted can be easily changed through an ingenious system that permits unlimited variation of the reading matter according to need and occasion.

In the accompanying illustrations shown at top is a miniature reproduction of a typical lamp-bank and below this a series of words flashed successively on this bank. This gives an idea of the effectiveness of the apparatus. Any number of sentences may be displayed in this manner before the entire series is repeated. The operation is entirely automatic and is effected by a rugged control mechanism that is protected from damage through arcing, overload or derangement. All parts of the system have been carefully worked out as to both electrical and mechanical details and the system possesses many unique features. One of these is its great flexibility in that it can be readily adapted to a great variety of purposes and conditions requiring lamp-banks of many different sizes and shapes.

The great utility of the Electrograph can be readily comprehended from the foregoing brief description. Whether large or small, it can be used wherever electricity is supplied. The distinctive character of the device is that it talks to many people at a time who could not be reached successfully by loud-speaking telephones. It is an apparatus that fills a long felt want and will not become monotonous or out of date. If handled rightly it should prove to be a splendid

Lamp-Bank and Successive Flash Indications of Electrograph.

money-maker when exploited in connection with general advertising talk in any locality.

Development of this new invention has been perfected by the Electrograph Company, 53 West Jackson Boulevard, Chicago, Ill. Further information may be obtained from the company by responsible parties who state in what capacity they are interested in the apparatus.

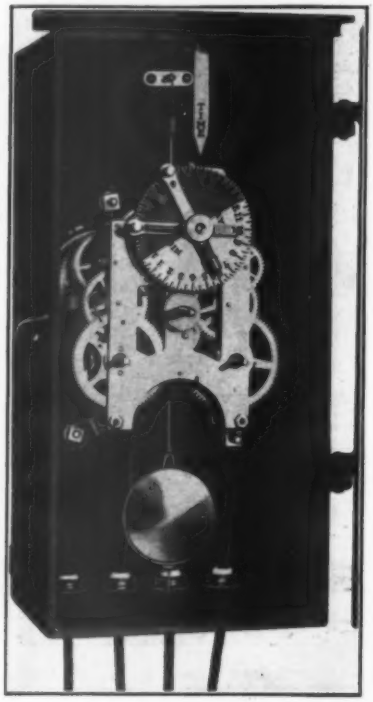
## Improved Form of Time Switch.

The increasing use of time switches for the automatic control of circuits under greatly varying conditions has introduced new requirements into their design. These requirements, combined with the results of an experience of several years in the manufacture of

time switches, have led the National Time Switch Company, South Bend, Ind., to place on the market a time switch of improved design. The clock employed has a pendulum movement that keeps accurate time independently of weather changes or vibrations; this movement is adjustable by a patented device.

As shown in the illustration herewith, the switch-setting arrangement has been improved by using for it a large dial with two hands, instead of two smaller dials with small pointers; this makes it easier to set or reset the switch-operating time and loosening of the dials is also avoided.

The switch-operating mechanism is entirely separate from the timing train of the clock, so that the latter is not affected by operation of the switch. An approved rotary snap switch is now



Mechanism of Improved Time Switch.

used to turn lights on and off, instead of the former knife switch; this necessitated a radical change in the mechanism, which is now simpler and more rugged.

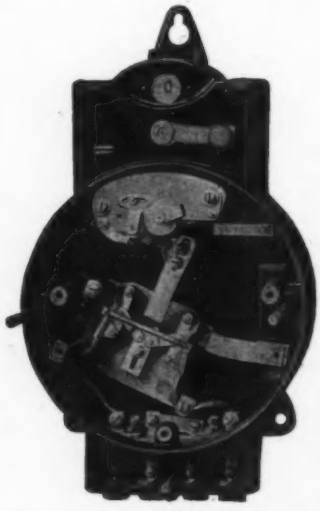
National time switches are built for capacities ranging from 10 to 150 amperes. Some of these are intended for indoor use and are provided with attractive oak, mahogany, walnut or special finishes. The type illustrated has a sealed cast-iron case for use outdoors or indoors. Only the hinged edge of door is shown. The switches for very heavy currents have special quick-break brush contacts. All these time switches are provided with eight-day clocks that require winding only once a week.

## New Prepayment Watt-Hour Meter.

The Westinghouse Electric & Manufacturing Company has recently added a prepayment feature to its standard line of type OA watt-hour meters. This prepayment meter is especially useful when supplying current to small con-

Westinghouse Prepayment Meter.

sumers, as it collects the bill and saves bookkeeping. It is also useful in supplying a shifting population, such as at summer resorts, because it saves following up the consumer to collect the bill.



Prepayment Mechanism of Meter.

The prepayment mechanism is arranged to receive quarters and not only registers the amount of energy consumed, but indicates by an additional dial the number of quarters up to ten remaining to the credit of the consumer. As energy to the value of each quarter prepaid is consumed, the dial changes to indicate one less quarter credited. When no more coins remain to the credit of the consumer the supply is shut off automatically. The coin box will hold as much as $25 in quarters.

The prepayment mechanism, including the cutout, is entirely mechanical and entirely contained in the meter. The cutout switch operates by means of gears and levers and is therefore positive in its action.

Meters are regularly furnished in capacities from 5 to 25 amperes, 100 and 200 volts, 60 cycles, and for rates varying from 5 cents to 20 cents per kilowatt-hour in full cents only. Except for the prepayment and cutout mechanism, these meters are the same as the type OA meters manufactured by the company.

## Presto Two-Cell Lantern.

The Presto electric two-cell hand lamp shown herewith is equipped with a three-volt bulb and a three-inch bull's eye lens. It is a complete lighting set in black-enameled case seven inches high. A strong light is produced by a high-efficiency three-volt Mazda lamp

New Two-Cell Electric Lantern.

and two ordinary No. 6 dry cells. It is an absolutely safe light around the house, barn or garage, doing away with all dangerous flame lamps, and can be carried by the bail as a lantern or hung on a peg and the light turned to any position desired. The revolving head is pivoted on the supporting bracket, so that it may be rotated to throw the light in any direction, either straight up or down. It gives ample light for reading when used as a reading lamp. The light may be turned on or off instantly by giving the switch a slight turn at the back of the reflector.

This new Presto lantern is manufactured by the Metal Specialties Manufacturing Company, 738 West Monroe Street, Chicago, Ill.

## New High-Resistance Pyrometer Instruments.

A new line of high-resistance thermo-electric pyrometers for temperatures up to 3,000 degrees Fahrenheit, is being placed on the market by the Bristol Company, Waterbury, Conn. The millivoltmeter movements of these new instruments are all of the

pivot-jewel-bearing, dead-beat type, and are made by the Weston Electrical Instrument Company especially for use with thermocouples. These instruments may be used with Bristol patented base-metal couples for measuring temperatures up to 2,000 degrees Fahrenheit and with standard platinum-platinum-rhodium couples or the Bristol patent compound couples with platinum-platinum-rhodium tips for measuring temperatures up to 3,000.

In former issues of this journal the low-resistance system of Bristol thermo-electric pyrometers was described as being suitable for temperatures up to 2,000 degrees Fahrenheit. The low-resistance system includes Weston pivot-jewel-bearing instruments and Bristol base-metal couples which may be used together, because the resistance of the latter is very low and changes of the resistance in the couple when heated in sections of varying length are negligible.

These new high-resistance models illustrated herewith can be used with standard platinum-platinum-rhodium couples for temperatures as high as 3,000 because the resistances of these instruments are so high that the changes of resistance in the standard platinum couples are an extremely small and negligible percentage of the entire resistance of the circuit. Therefore, with these high-resistance instruments there are no appreciable errors due to ordinary changes of resistance in the circuit. They may be used under varying atmospheric temperature conditions and interchangeably with leads of various different lengths within certain limits.

Fig. 2.—Portable Electric Pyrometer.

than one per cent for a change of 25 Fahrenheit degrees.

When calibrated for a scale range of 2,000 degrees for use with base-metal couple, or for a range of approximately 65 millivolts, the resistance of the instrument would be upward of 350 ohms and the temperature error of the instrument would consequently be less than one per cent for a change of 75 Fahrenheit degrees. This extremely high resistance also makes these instruments practically independent of length of leads and length of couples.

The high sensibility of these new instruments also makes them available for low ranges of temperature where an open scale is required.

These instruments are provided with zero-adjusting devices which afford a simple and quick way of adjustment for different "cold-end temperatures," and as the movements are of the pivot-jewel-bearing type they are not affected by ordinary vibrations in shops.

The switchboard model is provided with a normal index that can be set at any desired point on the scale. The portable model weighs about 6 pounds, 6 ounces. This instrument does not have to be leveled carefully in order to obtain an accurate reading. Both are provided with dustproof cases, and the wall-type instrument can therefore be used without any extra protecting case.

High-resistance instruments of this character embody the highest class of workmanship and construction. They are practical pyrometers for commercial and shop use having a very high degree of accuracy, and may be used with great flexibility.

## New Decade Testing Set.

A new testing set, known as the Peerless switch-dial decade testing set, has been placed on the market by the Thompson-Levering Company, Philadelphia, Pa. This set embodies a number of distinct features.

It was designed for use by the ordinary workman and has been so simplified that it does not require any advanced technical education to obtain very accurate results. The directions for making all tests are printed on a card which is attached to the lid of the set, and the simple circuit design used, doing away with all complication usually found in testing sets, has made it a universal instrument for all classes of men, from the ordinary lineman to the electrical engineer.

The rheostat consists of four decades of ten coils each, having values of units, tens, hundreds and thousands of ohms, accurate to one-tenth of one per cent. The bridge coils are accurate to one-twentieth of one per cent.

The instrument has a self-contained,

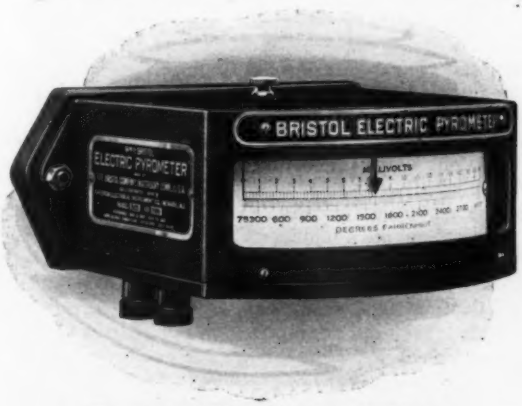



Fig. 1.—Switchboard-Type Pyrometer.

New Decade Testing Set.

removable galvanometer and also a self-contained battery. Provision is made by means of binding posts to permit using an outside battery when a higher electromotive force is desired than that given by the cells in the set, which are ample for ordinary testing.

A new design of the test switch, which was particularly made for this set, is so arranged that when a resistance test is to be made the indicator is turned to *W. B.*, which shows that the Wheatstone-bridge connections are in circuit. When desiring to make the Varley-loop test, it is only necessary to turn the test switch to the indication *V. L.*, when the connections for this test are in circuit. To make the Murray-loop test, the test switch is turned to *M. L.*, thus the test settings are made automatically and the special switch eliminates the two knife switches which it is necessary to operate on other test sets to obtain the correct electrical connections. This set therefore eliminates all possibility of error in switch settings, as well as the chances of throwing one switch and forgetting to throw the other.

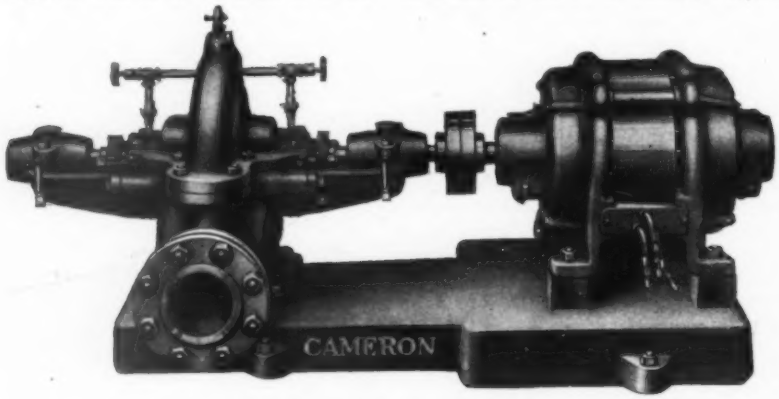
The new method of indicating the resistance eliminates all chance of error in reading the results, as the dial only is turned and the contact made on the various values of coils. The value of the particular coil thus in circuit is shown in a small circular window at the side of the dial handle, and one number only is visible, so that no possible error can occur in reading the amount. Each dial is provided with a detent, so that when the brush is full on the block the position is indicated not only by the value in the window, but also by the positive automatic detent with click, allowing one to tell by feel or sound, without looking at the dial, when the brush is in the center of the contact stud.

The removable galvanometer is provided with shunt protection, which is a desirable feature when using a high external electromotive force for battery potential. Shunts for removable galvanometers are not provided in similar test sets. The galvanometer is of the D'Arsonval moving-coil type and is of rugged construction. The moving system is light in weight and of high sensitivity.

This Peerless testing set is serviceable for all purposes where accurate and speedy testing of resistance values is involved. Its simplicity of manipulation and the improbability of wrong interpretation of its results adapts the outfit to a much greater number of uses than has usually been possible in ordinary testing sets. Its price is also moderate.

## Cameron Electricaly Driven Irrigation Pumps.

In irrigation by electric pumping, centrifugal pumps are almost invariably used. In the design and construction of these pumps great care is necessary in order to maintain high efficiency. This is a subject that has been given much attention by the A. S. Cameron Steam Pump Works, 11 Broadway, New York City. The pump illustrated herewith is particularly suitable for irrigation work by electric pumping.




Electrically Driven Centrifugal Pump.

It is of the single-stage, double-suction volute centrifugal type with horizontally split casing to give ready access to the interior for cleaning and repairing. The pump has a double-suction impeller of the inclosed type that is perfectly balanced, eliminating end thrust entirely. The volute chamber and impeller are so proportioned as to meet the hydraulic conditions designed for with the maximum efficiency. These pumps can be used for heads up to 200 feet. For priming and draining, openings of proper size are provided at the top and bottom of the cast-iron casing. A flexible coupling is furnished for direct connection to the motor shaft. All the materials and workmanship of the pumps are of the highest class. Each pump is tested before shipment for the conditions specified and guaranteed.

## Electrically Driven Automatic Razor-Blade-Sharpening Machine.

The outfit illustrated herewith is made for sharpening the blades of any of the 300 odd makes of safety razors now on the market. It has a capacity of twelve blades at a time of any make, and will sharpen ten dozen blades per hour.

The blades are held by steel spring jaws, which are compressed with a toggle joint. Pressure of the thumb lever forces the spring steel jaws together. To remove the blades all that is necessary is to raise this lever. Blades are sharpened by a roller, against which they are held by the spring jaws. There are four of these rollers with a capacity of twelve blades each. As the rollers revolve they also oscillate back and forth, so there is no possibility of them being worn unevenly.

By means of a set-screw adjustment the blade angle can be changed to give any desired bevel to the edge, so as to adapt the machine to the different bevels to which different makes of blades are originally ground.

Electric Razor-Blade Sharpener.

The left end of the two lower rollers is covered with a different material than is used in the main roller. This material is abrasive and is used for honing nicked blades.

The machine is finished attractively to adapt it for use in show windows, as it has proved to be a good attention-getter for the store which places it in the window.

The machine is equipped with a one-sixth horsepower motor manufactured by the Robbins & Myers Company, Springfield, O. The outfits are manufactured and sold by the Hyfield Manufacturing Company, 48 Franklin Street, New York City.

## Dimming and Pump-Control Equipment in Harper Theater.

The number of medium-sized playhouses has increased considerably during the past five years. A typical

theater of this class is the new Harper Theater located at Fifty-third and Harper Streets, Chicago, Ill. In this theater a small 10-plate dimmer bank mounted just above the switchboard provides for the necessary stage-lighting effects. This equipment, shown in Fig. 1, consists of duplex plates made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., and installed by W. H. Brown & Company, electrical contractors. These ten plates carry resistance and contact segments on each side, this construction making it possible to save space. It also makes it possible to use one plate as a complete two-wire or a complete three-wire dimmer.

The basement of this building is automatically kept free from water by two five-horsepower motor-driven sump pumps controlled by Cutler-Hammer float switches and automatic motor starters. In Fig. 2 one of the automatic starters is shown mounted on a post. On the back of this post a float switch is installed which is operated by a rod on a float in the sump. As the water rises in the sump the float and its rod move upward. At a predetermined level the float switch is tripped shut and this energizes the automatic starter and connects the motor to the line. When the water level has dropped, the float switch is opened and the motor disconnected. The action is automatic.

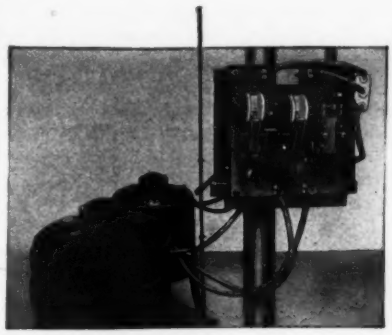


Fig. 2.—Motor-Driven Sump Pumps With Automatic Starter.

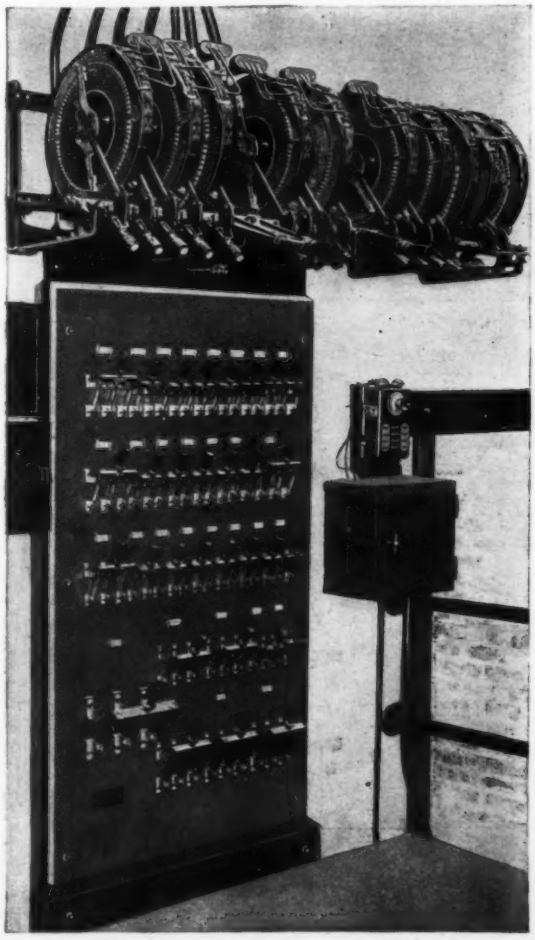


Fig. 1.—Dimmers and Switchboard in Harper Theater.

## Stream Flow.

The diversion of water for the development of power at Niagara has recently claimed the attention of both the countries interested, and another question quite as important now is that of the propriety of permitting the city of Chicago to divert large volumes of water from Lake Michigan through its drainage canal into Illinois River.

Water-Supply Paper 354 is the latest of a series of annual volumes covering measurements on the principal streams of the St. Lawrence basin. The work done in Minnesota, New York and Vermont was in co-operation with the state authorities. A copy of the report may be obtained on application to the director of the United States Geological Survey, Washington, D. C.

## Erie Motor-Driven Irrigation Pumps.

A large number of motor-driven centrifugal pumps for irrigation and similar service has been built by the Erie Pump & Equipment Company, Erie, Pa. For this service both single-suction and double-suction pumps are supplied. Fig. 1 shows one of the former. For high heads, two-stage or compound pumps, of the type shown in Fig. 2, are furnished. These are suitable for a maximum total head of 200 feet.

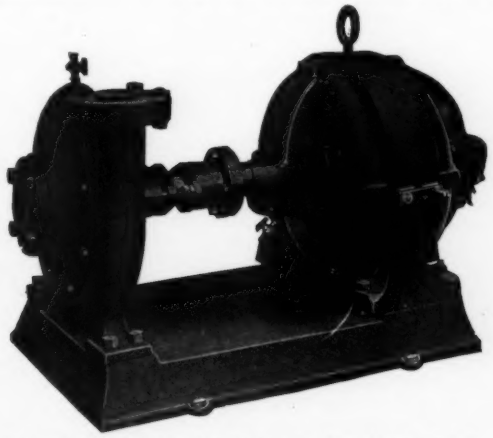


Fig. 1.—Single-Suction Motor-Driven Centrifugal Pump.

Pumps smaller than the two-inch size have open-type impellers. Those larger than this size have the inclosed or shrouded type of impeller. In all these pumps the suction and discharge openings are furnished in various positions to meet conditions. The pumps are built in various sizes ranging from an economical capacity of 15 to 4,300 gallons per minute. Great care is exercised in all features of the design and the construction embodies only high-class workmanship.

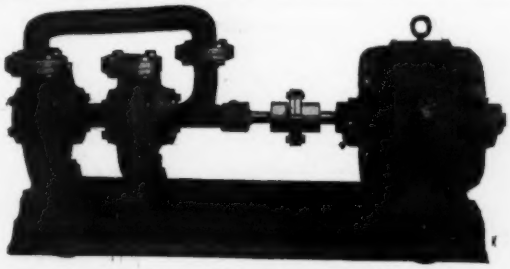
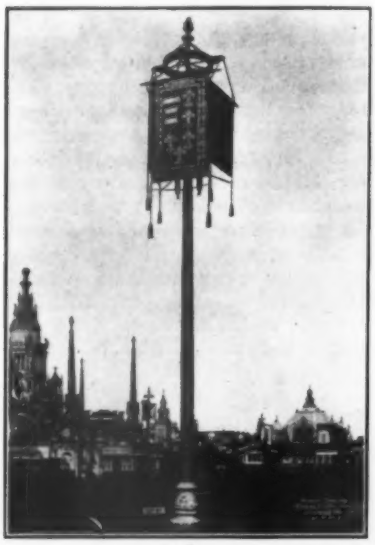


Fig. 2.—Two-Stage Motor-Driven Centrifugal Pump.

## Illumination by Ornamental Luminous Arc Lamps at Panama-Pacific International Exposition.

The illumination of the Panama-Pacific International Exposition transcends all previous efforts of the kind, both in magnitude and grandeur, and marks an epoch in the science of lighting and art of illumination. But few of the many thousands of visitors realize that all this great flood of light from concealed sources was worked out scientifically in its entirety to secure the proper selection and arrangement of lamps for this marvelous expression of illuminating art.



Front View of Banner Standard With Luminous Arc Lamp.

Rear View of Standard, Showing Arrangement of the Lamps.

Different lighting units of the General Electric Company are used to accomplish the results desired, including the Mazda incandescent lamp, the searchlight or projector and the ornamental luminous arc lamp. For interiors thousands of Mazda lamps furnish the light, which shines through colored panes of glass and gives the buildings the cheerful appearance of being inhabited. Mazda lamps also produce practically all the exterior lighting in the grand courts among the exhibit palaces, and the interior and exterior lighting of the Amusement Zone. All the towers are illuminated by searchlights or projectors, concealed on the roofs of the surrounding buildings. Searchlights are likewise the source of light in the scintillator, which floods the sky over the exposition with light of varying color thrown on clouds of smoke and jets of steam.

The nine main exhibit palaces, in addition to Festival Hall, Horticultural Palace, and the Service building, have their outer walls illuminated by ornamental luminous arc lamps. The lamps are concealed behind translucent banners of artistic heraldic design and plaster shields. The banners are placed partly around the lamps and are of such a density as to allow just enough light to pass through to show their designs and colors, while the greatest flood of light is reflected directly against the walls of the buildings.

The general lighting scheme was designed by W. D'Arcy Ryan, chief of illumination, and the details were worked out by himself and his assistants in the illuminating laboratories of the General Electric Company, of which he is the illuminating engineer.

South End of Machinery Palace Illuminated by Luminous Arc Lamps.

From the beginning the idea was to have the lighting arranged so as to give one walking through the avenues the impression of being in a theater. The buildings, the shrubbery, the flowers and the trees represent the stage, and there is no detail of architecture that cannot be seen with equal enjoyment by night as well as by day. All the true colors of the flowers and trees surrounding the buildings are brought out by the clear white light of the ornamental luminous arc lamp. This white light has also been employed to express in their true colorings the beautiful soft tints and delicate shades that were selected by Jules Guerin, chief of color, for the building exteriors.

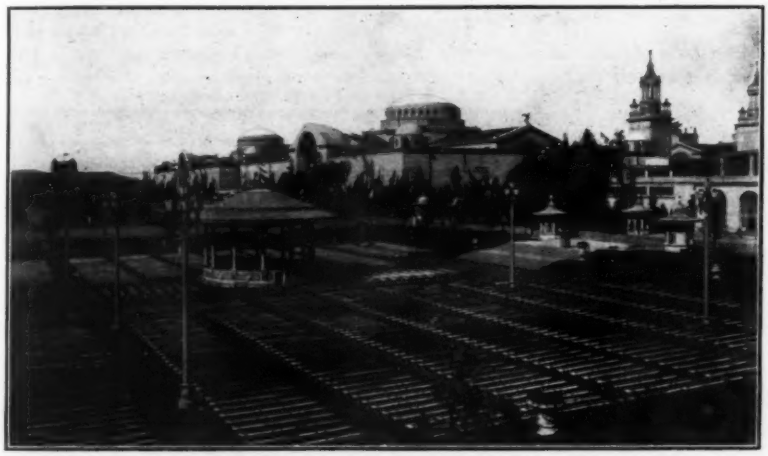
Instead of being mounted on single-lamp standards, the ornamental luminous arc lamps are grouped. Some standards have two, three, five, seven and nine lamps each. These standards, of artistic design, are of different heights, from 25 to 50 feet, to correspond to the height of the walls of the buildings they are lighting. The spacing of the standards ranges from 50 to 65 feet, in conformity with the area lighted and intensity desired. Solid wooden poles support the framework or crossarm on which the lamps rest. A groove is cut in the side of each post for imbedding the cable, after which the opening is closed by strips of wood. About 900 lamps are in operation at the present time, each circuit containing approximately 75 lamps.

The Band Concourse is an open-air resting place where band concerts are given daily. This large space is also lighted by ornamental luminous arc lamps, with leaded glass shades surrounding the globes. There are five lamps to each post, four at one level and the fifth in the center a little higher up. These standards are of attractive design and make as fine an appearance in the daytime as at night. East of the Palace of Machinery in a large freight yard are eight more of these five-lamp standards, without the leaded glass

shades. These lamps burn all night and aid very much in unloading cars.

There are several lessons to be learned from this style of lighting, in the opinion of General Electric engineers. One in particular is that grouping lamps is of great advantage for accomplishing certain illuminating results. There are places in many cities where this arrangement could be used effectively. On streets or sections of streets that are exceptionally wide, say 100 feet or more, two or three-lamp posts can be used to better advantage than single-lamp posts, placed so as to try to secure adequate illumination. Often public buildings are set back from the curbing a considerable distance, and one or two extra lamps on posts in such localities will bring out the buildings with the desired prominence. At street corners or in parks there are a great many instances where as many as five lamps on a standard should be recommended.

It is not necessary to use banners or shields for lighting streets in the same manner as had been done at the Exposition. In fact, there will be very little occasion to use such decoration in a city, unless it should be in some section where it would be appropriate and effective to display the city or state seal, or some figure symbolic of local progress. In conection with special festivals it would be very appropriate.



Band Concourse, Showing Luminous Arc Lamps With Leaded-Glass Shades.

## New V. V. Conduit Fittings.

Following its established policy of developing new conduit fittings to meet new and definite demands, the V. V. Fittings Company, Philadelphia, Pa., has recently added quite a few fittings to its already large assortment. These are listed for the first time in the company's new, comprehensive catalog. Space permits mention here of but a few of these new fittings, all of which are manufactured to the company's established standards.

Among these is a weatherproof sign fitting, shown in Fig. 1, that is especially adapted for outside work. The wire outlets are set at an angle of 45 degrees and a straight pull can be exerted on the wires when connecting up the fitting. This fitting is made in all sizes from one-half inch to four inches, inclusive.

Fig. 1.—Weatherproof Sign Fitting.

Figs. 2 and 3 show dead-end and "T" fittings with nipple and snap-switch porcelain covers. A straight-through fitting of this type is also made. In each case the covers with attachments, including receptacle, are interchangeable on the three types of fittings. The receptacle cover, not shown, can be easily wired and its neat design makes of it an attractive installation.

New designs have been adopted for the angle fittings known as types LFB and LW, the former being shown in Fig. 4. In each case a straight pull can be had on the wires. On the LFB fittings there are covers on both sides, so that the fitting can be used either as a front or back fitting, giving ample room in which to work and also making a neat installation. The LW fitting is weatherproof outside fitting arranged with heavy rubber gaskets between a protruding flange, making it impossible for dampness to get into the chamber of the fitting. The large opening for pulling in the wires is provided to prevent making short bends and kinks in the wire.

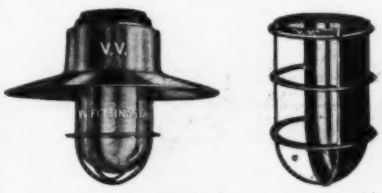
Figs. 2 and 3.—Dead-End Fitting With Nipple Cover. "T" Fitting With Switch Cover.

Figs. 4 and 5.—New Design of Angle Fitting. Vaporproof Fitting With "L" Attachment.

To the vaporproof line of fittings has been added an "L" attachment whereby it is possible to place the vaporproof fitting at many angles without purchasing a different fitting for every angle which is required in the installation. Vaporproof fittings are furnished complete with receptacle and can be easily wired. Fig. 5 shows one of the many angles and ways in which the new vaporproof fittings can now be used. Another addition to the vaporproof line is covered by a twin vaporproof fitting. such as shown in Fig. 6. This arrangement consists of standard vaporproof parts, all gaskets being of leather, thoroughly oil-soaked to make an absolutely vaporproof arrangement. All of these fittings are especially adapted for gas houses, mines, tunnels, outdoor, damp and dusty places.

Fig. 6.—Twin Vaporproof Fitting.

Reflectors, reflecting guards and flaring reflectors have been also added to the vaporproof-fitting line, and Figs. 7 and 8 show two of the various designs which are now listed. These new reflectors are designed to correctly and economically distribute light in subways, corridors, factories, warehouses, etc. They are finished not merely for attractive appearance and good wearing qualities, but give a strong light reflected in the desired direction.



Figs. 7 and 8.—Two Types of Reflector Guards.

One of the most interesting additions to the V. V. line is shown in Fig. 9, the new no-splice block with rosette cover. This block is made to eliminate the splicing of wires in conduit fittings and do away with soldering, rubbering and taping splices, at the same time making a neat, compact installation. This tends to make short-circuits almost impossible and eliminates future trouble

Fig. 9.—No-Splice Block.

after the job has been completed. The no-splice block is made to take rosette covers or porcelain nipple covers and also the standard V. V. receptacle shown attached to the new angle piece in Fig. 10. This receptacle fits directly on the no-splice block, no wiring being necessary after the block has been connected.

Fig. 10 shows another interesting addition to the line. This is the 45-degree angle piece attached to a standard No. 1 size V. V. fitting. This angle

Fig. 10.—Fitting With Angle Piece and Receptacle.

piece will fit on various of these fittings and can be placed in any position thereon. The standard receptacle fits on the angle piece, no special receptacle being required for the fitting or angle piece.

Two new No. 2 size fittings have been added, as shown in Figs. 11 and 12. These fittings are made to take all No.

Figs. 11 and 12.—New "U" and "V" Fittings.

2 size covers, porcelain and iron, including the Hubbell cover, concealed-receptacle covers and various sizes of nipple covers.

The type P fittings have been arranged so that they will take various covers, such as single and double push-button switches, rotary switch, Hubbell plug receptacles and also screw plug receptacles. Figs. 13 and 14 show two of these covers, all of which will fit on the same box and are interchangeable.

Fig. 15 shows one of the new type Y fittings which has been added to the line. These are made in various sizes so as to take cutouts from 30 amperes to 100 amperes capacity and two and

Figs. 13 and 14.—Type P Fittings With Switch and Receptacle Covers.

three wires. They are made to take cutouts made by various manufacturers, leaving ample room for wiring connections. In each case the boxes can be had with outlets arranged in various ways to meet practically any requirement.

The new fittings also include the type Z series of fittings, one of which

Fig. 15.—One of the New Type Y Boxes.

is shown in Fig. 16. This series comprises a line of boxes arranged to take cutouts and having an extension for snap switches to control the outlets of the cutouts. These fittings are made to take various size conduits with outlets on all sides. Their installation makes a very neat job.

One of the most interesting additions is the type ZW series of fittings, which

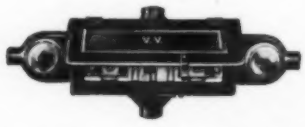



Fig. 16.—One of the New Type Z Boxes.

are made watertight and dustproof. They are made to guard against mechanical injuries and prevent operators from coming in contact with any live metal parts. The boxes are arranged with outlets on all sides and to take single and double-branch, new Code or plug fused cutouts and also five-ampere snap switches.

## Bryant Ceiling Pull Receptacle.

The Bryant Electric Company, Bridgeport, Conn., has brought out a new ceiling and wall receptacle with pull chain for concealed wiring. It is similar in general design to the receptacle described in our issue of November 21, 1914, but has the pull chain added. It is designed especially for a four-inch outlet box, but may be attached also to 3.25-inch boxes. In addition, it can be used for ordinary ceiling work, because of its perfectly flat back. This device measures 4.625 inches outside by only two inches deep. Holes for supporting screws are spaced on 3.5 and 2.75-inch centers. Binding screws are provided, to which loop wires may be readily attached.

Another receptacle similar in external appearance and dimensions, is supplied with two wires, or "pig tails," of suitable length to facilitate ready installation.

Bryant Ceiling Pull Receptacle.

## The Italian Market for Electrical Energy.

In an article in *Elettrotecnica*, G. Semenza carefully examines the future of the distribution of electric energy in Italy, where the consumption for power and light has actually reached a degree of regularity which discourages any probability of large increases. The hydraulic power utilization, on the contrary, is only beginning and it is only restrained on account of the limited demand of the market.

It is necessary to look out for new openings to absorb both the excess of the electric energy actually on the market, and that which may be produced in the future.

For such the author bases his hopes particularly on the different services in agriculture, on the electrification of railways and on the adoption, on a large scale, of electric heating and cooking.

The electrification of railways has been commenced on a good scale, but has not yet taken a decisive development ,and the adoption of electric heating and cooking has been, up to the present time, prevented by the existing tax on energy consumption.

Finally the author considers that a careful study should be made of the applications of electric energy to the chemical and metallurgical industries.

# Current Electrical News

### ATLANTIC STATES.

MANCHESTER, N. H.—An addition to the McElwain shoe plant is under construction. The equipment will include four new boilers aggregating 1,600 horsepower and engines and dynamos for electric generation. The factory has a fine motor equipment, which will be augmented. A storage battery will also be installed. The cost of the building and apparatus will be about $150,000. Fred T. Ley & Company, Springfield, Mass., are the general contractors. W.

MARIETTA, W. VA.—The city council has declared in favor of a municipal electric lighting plant. For the present the plant will not go after commercial business.

### NORTH CENTRAL STATES.

CINCINNATI, O.—A generating plant of considerable size, with wiring motors, and other equipment, is included in the plans for the new Walnut Hills-Hyde Park High School, by Garber & Woodward, which have been approved by the Board of Education. The buildings and their equipment will cost in the neighborhood of $3,000,000. L.

PIQUA, O.—The Springfield, Troy and Piqua Traction Company has received county franchise which will permit it to furnish current to the villages of Dialton, Northampton and Lawrenceville, and will at once run lines for that purpose. Street lighting and a considerable amount of mercantile and household work will call for much construction in the towns during the summer. L.

SALEM, O.—The power wiring, fire alarm system, electric clocks and telephone exchange, will be placed in the new high school building by the G. A. Webster Electric Company of Youngstown, for $2,995.45.

SANDUSKY, O.—Of $750,000 of bonds, which will at once be issued out of a total of $3,000,000 authorized by the board of directors of the Sandusky Gas and Electric Company, $250,000 will go to pay for the new ornamental street lighting system in Sandusky, which is being constructed. L.

SPRINGFIELD, O.—Data covering the relative cost of electricity and gas for street lighting, various types of ornamental lighting equipment and other details for a proposed new cluster lighting system are being considered by City Manager Charles E. Ashburner, who will shortly make recommendations to the city commission on the subject. L.

ZANESVILLE, O.—Lights for the new Sixth Street bridge, to the number of about 60, of the cluster type, will be installed by the Fergus Electric Company, to which the contract has been let by McClintock-Marshall Company.

SULLIVAN, ILL.—Business men of Sullivan are planning the erection of a municipal electric lighting plant.

WESTBY, WIS.—The council is planning ways and means to establish a $20,000 water and light plant. Address village clerk.

PAYNESVILLE, MINN.—At a special election held May 17, the citizens of this village voted to sell the municipally operated electric light and power plant to A. G. Whitney, of the Union Power Company, St. Cloud. A committee was appointed later by the council to draw up a contract for the deal. X.

BISMARCK, N. D.—Articles of incorporation were issued May 25 to the Kuhn Telephone Company, of Richardton, N. D. The capital stock of the company is $10,000. It expects to build about 25 miles of line during the summer. X.

CHARLES CITY, IOWA.—The Cedar Valley Power Company has sold its right and franchises to the Cedar Valley Electric Company, which is owned and controlled by the American Gas Company, of Philadelphia. All the business, as heretofore conducted by the Cedar Valley Power Company, will be conducted by the new corporation, with headquarters at Charles City. It is the intention of the company now owning the franchises and plants of the Cedar Valley Electric Company, to immediately connect up Hansell, Dumont, Bristow and Allison with the Hampton plant, and furnish these towns with electricity.

CHILHOWEE, MO.—The sum of $6,800 has been voted to purchase a light plant. Address town clerk.

### SOUTH CENTRAL STATES.

ASHLAND, KY.—The Ashland Electric Light and Power Company has increased its capital from $25,000 to $32,000.

HARRODSBURG, KY.—Promoters of the Dick's River Power Company, who propose to construct a hydroelectric plant near here, are clearing up the titles to their purchases of land and getting in shape to begin more definite work. It is said to be assured that the project to construct the dam will be realized.

MIDDLESBORO, KY.—An electric power plant, to furnish light and power to the mines and towns of Harlan County, is being considered by Cincinnati capitalists. It is stated that a plant costing $250,000 is contemplated.

MT. OLIVET, KY.—The Robertson County Light and Power Company, which is constructing an electric light plant here, has contracted for the equipment from M. R. Binnett, of Cleveland, O. Construction of the distribution system has begun and it is expected that service will begin in the near future.

BRISTOL, TENN.—This city has been granted legislative authority to issue $100,000 in bonds to construct a municipal electric light plant.

DRESDEN, TENN.—Work is proceeding rapidly on both the waterworks system and the electric light plant which the city is building with the proceeds of a $27,000 bond issue recently sold. The cost of the plant will reach $30,000 it is stated, and it is expected that they will be in operation by the first of August.

MILAN, TENN.—The city will expend about $8,000 to improve present light and water systems. Address J. D. Denney.

McGREGOR, TEX.—The Texas Power and Light Company, of Dallas, Tex., purchased the electric light plant at McGregor; will build transmission line from Waco to Temple and tap line from Eddy, via Moody to McGregor.

McKINNEY, TEX.—The McKinney Ice, Light and Coal Company has been sold to Isadore Newman & Sons, bankers, of New Orleans, La. George T. Cobb will remain as vice-president and general manager. Extensive improvements are contemplated.

### WESTERN STATES.

ANACONDA, MONT.—Recent reports state the city council has adopted a resolution providing for the installation of a lighting system on Commercial Avenue; stated city clerk will shortly call for bids for materials and installation. O.

HAILEY, IDAHO.—The city council has granted the Beaver River Power Company authority to distribute electricity for light, heat and power in this city.

NAMPA, IDAHO.—O. G. F. Markhus, receiver of the Idaho Railway, Light and Power Company, has completed negotiations with the Stephens Orchard Company, whereby the power company will extend its electric transmission lines to the orchards, to furnish light and power for the irrigation system and pumping plant. The extension will be made at an early date. O.

CENTRALIA, WASH.—Application has been made to the commissioners of Lewis county by Charles C. Smith for a franchise to construct electric power lines in the county.

EPHRATA, WASH.—It is understood C. J. Weller, of Wilson Creek, near here, will install a small power plant in Ephrata, to furnish the city with current for light and power. O.

OLYMPIA, WASH.—The application of George H. Tilden for a franchise to construct transmission lines for electric power, light, heat and telephone purposes in Thurston County will be heard by the County Commissioners on June 15.

PORT TOWNSEND, WASH.—C.

J. Erickson, New York Block, Seattle, who was recently granted a franchise by the city council, here, for the construction and operation of street railways, telephone and telegraph, and light and power lines, has relinquished same to the Port Townsend and Puget Sound Railway, according to an announcement of C. S. Shank, attorney for the railway company. O.

SEATTLE, WASH.—An application for a franchise to furnish current for both light and power on Mercer Island, and to string transmission wires in this territory, has been filed with King County Commissioners, Byron Phelps, clerk, by the Puget Sound Traction, Light and Power Company, of the Stone & Webster Corporation. O.

SEATLE, WASH. — In a recent proposition to the city of Seattle, P. H. Hebb, of the Mountain Development Company, offered to furnish under a contract to run 40 years 20,000 continuous horsepower at one-third cent per kilowatt-hour, and to increase this supply to 50,000 horsepower on a year's notice, at one-fourth cent per kilowatt-hour. The Mountain Development Company, of which P. H. Hebb is the head, offered the site which is located on White River, to the city of Seattle, and the proposition to purchase favorably voted on by the voters, although no bonds to cover the cost were voted. The court later decided the vote was advisory, and not mandatory, and the proposition of purchasing was dropped. The city of Seattle is looking to the future in the matter of additional power supply. O.

SPOKANE, WASH.—The Spokane county commissioners have granted a franchise for a power line from Deer Park to the property of the Arcadia Orchards Company to the Little Spokane Light and Power Company, of this city. Reported the company will make the extension at once. O.

SPOKANE, WASH.—Mayor C. M. Fassett, chairman of the committee which was appointed by the city commission, to investigate the feasibility of establishing a municipal light and power plant to furnish this city with current, in a recent report to the city commission, advised rejection of the plan, stating that the expenditure necessary, and result obtainable, would not justify the outlay. City Engineer Morton MacCartney states that in his opinion less than half the light and power business in the city of Spokane could be obtained by the municipal plant. O.

TACOMA, WASH.—New luminous arc residence street lamps, of the type which were recently installed in a portion of the residence district of this city, have been petitioned for by property owners in the North End, the petition covering 50 blocks. Electrical Superintendent Collins has prepared plans and specifications and states the cost will average about $6.00 per lot. The proposed district is made up of all the streets from North Twenty-first to Thirtieth Street, inclusive from Anderson Street to Union Avenue. It is also reported property owners from Ninth to Fifteenth Streets, Tacoma Avenue, are circulating a petition for the same type of improvement. O.

GOLD HILL, ORE.—At a special referendum election held in this city recently, the resolution of the California Oregon Power Company for the installation of a street-lighting system and for the installation of an electric-pumping system and the supplying of electric current for operation of both, for a period of 10 years, was defeated. O.

MILWAUKEE, ORE.—Reported the city council has granted a 25-year franchise to the Portland Gas and Coke Company, to furnish gas and lay mains in this city. O.

SALEM, ORE.—The Portland Railway, Light and Power Company, of Portland, has been given a five-year contract to furnish the city of Salem with light. Under the contract the company will install 400 candlepower incandescent lamps throughout the city in place of the present arcs, and a rate of $4.40 per lamp will be charged. O.

LOS ANGELES, CAL.—The Board of Supervisors has called for bids for improvement work in the Belvedere lighting district.

LOS ANGELES, CAL.—Preparations are under way for the extension of the lighting system to the recently annexed San Fernando Valley and Palms districts.

LOYALTON, CAL.—The Board of Trustees will shortly call for an election on the proposition of the construction of a municipal electric light and power plant.

RIVERBANK, CAL.—Bids will be received up to June 15 for the installation of a street-lighting system here.

## PROPOSALS.

ELECTRIC FIXTURES. — Sealed proposals will be received until June 21 by the State Board of Administration, State Capitol Building, Springfield, Ill., for furnishing and installing electric fixtures for about 30 state institutions. Specifications and blue prints, showing style, number and size of fixtures, will be furnished upon application to Frank D. Whipp, Fiscal Supervisor, Board of Administration.

LIGHTING FIXTURES. — Sealed bids will be received until June 10 at the office of the supervising architect, Treasury Department, Washington, D. C., for a conduit and wiring system, lighting fixtures, etc., to be installed at the United States post office, court house, etc., at Ogdensburg, N. Y. Address James A. Wetmore, acting supervising architect, Washington, D. C.

SPRINGFIELD, ILL.—The State Board of Administration will receive bids at its office in the capitol here up to 3 p. m. Monday, June 21, for furnishing and installing electric fixtures for the following institutions: Elgin State Hospital, Elgin, Ill. — Psychopathic building; Kankakee State Hospital, Kankakee, Ill. — Tubercular cottage; Peoria State Hospital, South Bartonville, Ill.—Receiving cottage; Anna State Hospital, Anna, Ill.—Tubercular cottage; Watertown State Hospital. Watertown, Ill.—Infirmary building, for men, female employees' building and tubercular cottage; Chicago State Hospital, Dunning, Ill.—Nurses' home, Untidy cottage, administration building, two receiving cottages and two other cottages; Lincoln State School and Colony, Lincoln, Ill.—South Hospital, addition to male cottage, addition to female cottage and tubercular cottage; State Training School for Girls, Geneva, Ill.—Farm cottage; St. Charles School for Boys, St. Charles, Ill.—Three cottages, institution group and three farm-cottages. Specifications and blue prints are on file at the office of Frank D. Whipp, fiscal supervisor of the board, at Springfield.

## FOREIGN TRADE OPPORTUNITIES.

*[Addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washingotn, D. C., or its branch offices at Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco. Write on separate sheet for each item and give file number.]*

LIGHTING PLANT AND TRAMWAY SYSTEM, NO. 16,950.—The commercial attaché of the Department of Commerce in Chile transmits a report relative to an opportunity for the sale of machinery and supplies for an electric lighting plant and tramway. Copies of this report may be had on application to the Bureau or its branch offices.

MACHINERY, NO. 16,955.—The commercial attaché of the Department of Commerce in the Netherlands reports that an engineer in that country desires to represent American manufacturers of machinery, especially electrical and agricultural. The man suggests that perhaps some American firms now maintaining their principal European offices in some of the belligerent countries might find it advantageous to transfer their agencies to a neutral country.

COPPER WIRE AND FITTINGS, NO. 17,002.—A firm in Italy informs an American consular officer that it desires to receive offers from American manufacturers of copper wire and fittings for electric lines. Correspondence may be in English. The firm states that it can furnish references.

INCANDESCENT LAMPS, NO. 17,019.—An American consular officer in Italy has transmitted a detailed report relative to a possible market for the sale of American incandescent lamps with drawn filaments, both in the vacuum and concentrated-filament gas-filled types.

## NEW PUBLICATIONS.

IOWA CENTRAL STATIONS.—Bulletin No. 38 of the Engineering Station, Iowa State College, is entitled "Electric Central-Station Operation in Iowa," by F. A. Fish and H. W. Wagner. It discusses the problems of central-station operation and contains a large number of tables, diagrams and illustrations.

UNIT OF CANDLEPOWER.—An article entitled "A Unit of Candlepower in White Light" by C. C. Paterson and B. P. Dudding, has been reprinted from the *Proceedings* of the Physical Society of London. This is concerned with the problems raised in making measurements of white light based upon a unit of candlepower which is not white.

EXPLOSION-PROOF MOTORS.—Technical Paper No. 101, published by the Bureau of Mines, Washington, D. C., is entitled "Permissible Explosion-Proof Electric Motors for Mines; Conditions and Requirements for Test and Approval," by H. H. Clark. This gives details of conditions which the bureau considers essential for satisfac-

tory service and describes tests for motors and accessories used in mining.

## NEW INCORPORATIONS.

NEW HAVEN, CONN.—The Yale Electric Company has been incorporated with a capital stock of $100,000, to manufacture electrical goods. The incorporators are George S. Rugin, New Haven; Arthur G. Olney, New York; George O. Brott, Hartford, Conn. W.

BOSTON, MASS.—Mayor Curley has promised the citizens of South Boston a new ornamental lighting system of large candlepower on Broadway in that district. W.

CHICAGO, ILL.—The Economy Electrical Specialty Company has been incorporated with a capital of $2,500. The incorporators are Christopher C. Buckels, D. G. McGilvray and B. C. Brever.

TOLEDO, O.—The Fowler Electrical Construction Company; capital, $10,000. Incorporators are Harry R. Fowler, Carlton F. Jones, Henry P. Fowler, Horatio C. Scannell and Ellen F. Fowler.

CROSS PLAINS, WIS.—The Cross Plains Electric Company has been incorporated with a capital of $5,000. The incorporators are F. J. Saeman, Henry M. Zander and James G. Bailey.

WAUPUN, WIS.—The Wisconsin Water, Light and Equipment Company has been incorporated with a capital of $10,000 by A. M. Baker, R. Schnutz and others.

VIVIAN, S. D.—Articles of incorporation have been filed for the Yellow Medicine Telephone Company, with a capital of $1,000. The incorporators are: A. N. Whittaker, G. J. Lintvedt, Ole K. Sletto.

BELFIELD, N. D.—The Chrysler Light and Power Company has been incorporated with a capital of $25,000. The incorporators are: George S. Chrysler, M. J. Coleman and John J. McManus.

WING, N. D.—The Wing Mutual Telephone Company has been organized with a capital of $10,000, by N. M. Christenson, B. E. Eid and W. H. Gambs.

CHICAGO, ILL. — Grayson Electrical Supply Company. Capital $1,000. Incorporators: Henry O'Grady, Ola F. Persson, Helen O'Grady and Jenn F. Persson.

GALVESTON, IND.—The Galveston Light and Power Company has been incorporated with a capital of $10,000. The business of the corporation is set out to furnish light and power for the city. W. H. Arnold, W. H. Arnett and others are the directors.

## FINANCIAL NOTES.

In speaking of the utility companies in which he is interested, Samuel Insull said that all companies in which he is directly interested are showing gross and net gains for the current year. The forthcoming report of Middle West Utilities Company for the fiscal year ended April 30, will make a satisfactory comparison with the preceding year. Rate reductions made by Commonwealth Edison last year totaled $850,000 but there will be no further rate reductions this year. Both Commonwealth Edison and Peoples Gas showed good gains for March but since that time earnings have not been up to the corresponding periods of a year ago owing to the labor troubles in the Chicago building trades.

### Dividends.

| | Term | Rate | Payable |
|---|---|---|---|
| Baltimore Elec., pf. | S-A | 2.5% | July 1 |
| Blackstone Val. Gas & Elec., com. | Q | $2.00 | June 1 |
| Blackstone Val. Gas & Elec., pf. | S-A | $3.00 | June 1 |
| Brooklyn Rap. Tran. | Q | 1.5% | July 1 |
| Chicago Telephone | Q | 2% | June 30 |
| Conn. Power, pf. | Q | $1.50 | June 1 |
| Con. Gas., Elec. Lt. & Pr., Balt. | Q | 1.75% | July 1 |
| El Paso Elec., pf. | S-A | $3.00 | July 12 |
| Elec. Prop., pf. | Q | 1.5% | June 10 |
| Louisville Trac., com. | Q | 1% | July 1 |
| Mackay Cos., com. | Q | 1.25% | July 1 |
| Mackay Cos., pf. | Q | 1% | July 1 |
| Montana Power, com. | Q | 0.5% | July 1 |
| Montana Power, pf. | Q | 1.75% | July 1 |
| So.-West Penn. Pr. & Lt. | — | 3% | July 1 |
| Thomson Elec. Weld. | Q | 5% | June 1 |

(Southwestern Power & Light Subsidiary)

### Reports of Earnings.

TEXAS POWER AND LIGHT.

| | 1915 | 1914 |
|---|---|---|
| April gross | $ 128,343 | $ 120,337 |
| Net after taxes | 44,823 | 41,495 |
| Surplus after charges | 19,363 | 18,606 |
| 12 months' gross | 1,656,213 | 1,330,993 |
| Net after taxes | 617,387 | 475,032 |
| Surplus after charges | 383,302 | 215,269 |
| Balance after preferred dividends | 205,310 | 105,019 |

FORT WORTH POWER AND LIGHT.

| | 1915 | 1914 |
|---|---|---|
| April gross | $ 70,012 | $ 67,039 |
| Net after taxes | 38,461 | 35,734 |
| Surplus after charges | 28,953 | 27,189 |
| Twelve months' gross | 911,557 | 751,351 |
| Net after taxes | 501,840 | 433,450 |
| Surplus after charges | 390,143 | 341,486 |
| Balance after preferred dividends | 323,409 | 286,633 |

STANDARD GAS & ELECTRIC.

Earnings of subsidiary companies of Standard Gas & Electric Company, for the year ended December 31, 1914, compare as follows:

| | 1914 | 1913 |
|---|---|---|
| Gross earnings | $14,354,689 | $12,926,288 |
| Net after taxes | 6,741,234 | 5,816,660 |
| Surplus after charges | 2,878,073 | 2,406,313 |
| Balance after dividends | 650,299 | 455,837 |

Earnings of Standard Gas & Electric Company from dividends and interest on stocks owned and proportion of undivided surplus of subsidiaries, for the year ended December 31, 1914, show:

| | 1914 | 1913 |
|---|---|---|
| Gross earnings | $1,940,068 | $1,933,624 |
| Expenses and interest | 855,064 | 787,804 |
| Net earnings | 1,085,003 | 1,145,819 |
| Preferred dividends at rate of 8 per cent. | 942,796 | 912,240 |
| Balance for common | *142,207 | 233,399 |

*Equivalent to 1.53 per cent on common stock.

HAVANA ELECTRIC RAILWAY, LIGHT & POWER.

The report of the Havana Electric Railway, Light & Power Company for the year ended December 31, 1914, compares as follows:

| | 1915 | 1914 |
|---|---|---|
| Gross | $ 5,396,714 | $ 5,417,054 |
| Net | 2,801,392 | 2,927,222 |
| Other income | 102,119 | 140,088 |
| Total income | 2,903,511 | 3,067,310 |
| Charges | 1,094,140 | 1,219,206 |
| Surplus | 1,809,371 | 1,848,103 |
| Acquired surplus* | ..... | 856,909 |
| Previous surplus | 1,313,457 | 294,749 |
| Total surplus | 3,122,828 | 2,999,662 |
| Dividends | 1,647,431 | 1,686,205 |
| Surplus | 1,475,397 | 1,313,457 |

*Excess in dividends received on stock of the Havana Electric Railway Company.

COLORADO POWER COMPANY.

Income account for year ended December 31, 1914:

| | 1914 | 1913 |
|---|---|---|
| Gross revenue | $746,869 | $692,585 |
| Expenses and taxes | 268,157 | 229,286 |
| Other income | 29,678 | 19,980 |
| Total income | 508,390 | 483,279 |
| Bond interest | 206,275 | |
| Preferred dividends | 29,704 | |
| Depreciation | 66,000 | |
| Surplus | 206,410 | |
| Previous surplus | 178,649 | |
| Total surplus | 385,059 | |

WISCONSIN EDISON.

| | 1915 | Changes from 1914 |
|---|---|---|
| April gross | $ 681,753 | Dec. 4.59% |
| Operating expenses | 416,273 | Dec. 5.75% |
| Net earnings | $ 265,480 | Inc. 2.69% |
| Balance available for Wisconsin Edison and depreciation | 128,318 | Dec. 4.98% |
| Twelve months' gross | 8,581,267 | Dec. 1.62% |
| Operating expenses | 5,073,548 | Dec. 0.80% |
| Net earnings | $3,507,719 | Dec. 2.78% |
| Balance available for Wisconsin Edison and depreciation | 1,881,380 | Dec. 8.57% |

Amount set aside for depreciation for the 12 months ended April 30, 1915, was $882,902, an increase of 4.09% over the preceding year.

UNITED LIGHT & RAILWAYS.

The consolidated income account of subsidiaries, for year ended December 31, 1914, compares as follows:

| | 1914 | 1913 |
|---|---|---|
| Gross earnings | $6,166,959 | $6,054,224 |
| Net earnings | 3,012,128 | 2,961,212 |
| Bal. after taxes and depreciation | 2,369,425 | 2,379,772 |
| Surplus after interest and dividends on preferred stock | 1,055,289 | 1,274,473 |

Income account of United Light & Railways Company, for year ended December 31, 1914:

| | | |
|---|---|---|
| Earnings on stock of subscribers | $1,039,783 | $1,116,254 |
| Dividends and interest received | 344,294 | 245,523 |
| Miscellaneous earnings | 123,155 | 87,494 |
| Total gross | 1,507,232 | 1,449,271 |
| Net after expenses and taxes | 1,392,617 | 1,344,413 |
| Surplus after interest and bond discount | 936,784 | 964,793 |
| Balance after preferred dividends | 410,711 | 450,605 |
| Maintenance and depreciation from current earnings | 558,743 | 525,595 |
| Maintenance reserve as Dec. 31 | 1,092,022 | 894,427 |
| Undivided surplus | 387,539 | 383,171 |
| Total surplus and reserve | 1,479,561 | 1,277,598 |

UNITED RAILWAYS & ELECTRIC OF BALTIMORE.

The annual report of the United Railways & Electric Company of Baltimore, for the year ended December 31, 1914, compares as follows:

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

| | May 31 | May 24 |
|---|---|---|
| American Tel. & Tel. (New York) | 119 | 118¾ |
| Commonwealth Edison (Chicago) | 132¾ | 133 |
| Edison Electric Illuminating (Boston) | 233½ | 233½ |
| Electric Storage Battery common (Philadelphia) | 50½ | 50¾ |
| Electric Storage Battery preferred (Philadelphia) | 50½ | 50¾ |
| General Electric (New York) (ex-dividend) | 151 | 152½ |
| Kings County Electric (New York) | 119 | 119 |
| Massachusetts Electric common (Boston) | 4¼ | 6 |
| Massachusetts Electric preferred (Boston) | 36¼ | 38 |
| National Carbon common (Chicago) | 131 | 131 |
| National Carbon preferred (Chicago) | — | 120 |
| New England Telephone (Boston) | 129 | 129 |
| Philadelphia Electric (Philadelphia) | 23½ | 23⅝ |
| Postal Telegraph and Cables common (New York) | 77 | 76 |
| Postal Telegraph and Cables preferred (New York) | 65 | 63 |
| Western Union (New York) | 66¼ | 66 |
| Westinghouse common (New York) | 93¼ | 96 |
| Westinghouse preferred (New York) | 120 | 120 |

| | 1914 | 1913 |
|---|---|---|
| Gross | $9,203,839 | $9,096,492 |
| Net | 4,891,400 | 4,900,061 |
| Total income | $4,916,121 | $4,907,006 |
| Charges, etc. | 2,964,826 | 2,927,468 |
| Operating income | $1,951,295 | $1,979,538 |
| Rentals account | 65,501 | 60,000 |
| Exting. securities | 37,950 | 37,950 |
| Balance | *$1,847,843 | $1,881,587 |
| Interest and preferred dividends | 560,000 | 560,000 |
| Common dividends | 818,448 | 791,362 |
| Balance to depreciation reserve | $469,395 | $530,225 |

*Equal, after providing for interest on income bonds and dividends on preferred stock, to 6.3 per cent earned on $20,461,200 common stock, compared with 6.4 per cent earned in 1913.

TENNESSEE RAILWAY, LIGHT & POWER.

Combined earnings of Tennessee Railway, Light & Power Company and its constituent corporations from May 1, 1912, to December 31, 1914:

| | |
|---|---|
| Gross earnings | $10,202,245 |
| Operating expenses | 5,353,996 |
| Net earnings | $ 4,848,250 |
| Taxes | 759,640 |
| Interest charges | 2,433,693 |
| Balance | $ 1,654,863 |
| Dividends on stocks not owned | 342,601 |
| Balance for Tennessee Ry., Light & Power | $ 1,312,262 |
| Preferred dividends | 1,120,059 |
| Balance available for renewals, etc., for company | $ 192,203 |

Combined earnings for year ended Dec. 31, 1914:

| | |
|---|---|
| Gross earnings | $ 3,762,387 |
| Net after taxes | 1,491,398 |
| Surplus after charges | 396,978 |
| Dividends on stocks not owned by T. R., L. & P. | 109,049 |
| Balance | $ 287,929 |

Causes for unsatisfactory showing in 1914 were the depression in business in industrial centers like Chattanooga and Nashville, resulting in decreased use of electric current for power and light and the dry weather which reduced the amount of hydroelectric power available for sale and forced the company to operate its steam plants to a large extent, thereby increasing operating costs greatly.

## PERSONAL MENTION.

DR. G. KLINGENBERG, director of the Allgemeine Elektrictiäts Gesellschaft, Berlin, Germany, has been decorated with the Order of the Iron Cross for services in the field.

MR. NORMAN S. ALEXANDER, for 10 years connected with the Cumberland County Power and Light Company, of Portland, Me., has been appointed general manager of the Fairmount Park Transportation Company.

MR. H. M. BYLLESBY addressed the members of the Psi Upsilon Club of Chicago at a dinner May 14, calling attention to what he conceived should be the attitude of Americans toward the present international conflict. He contrasted the ideals expressed by Abraham Lincoln with certain of those enunciated by leaders of present belligerents.

MR. A. JACKSON MARSHALL, executive secretary of the Electric Vehicle Association of America, was recently the guest of honor and principal speaker at a meeting of the Cincinnati branch of the association, held at the Hotel Gibson. One of the principal matters taken up by Mr. Marshall and discussed by the members was a cooperative advertising plan, to be participated in by members of the association all over the country, for the purpose of showing the public the advantages of the electric vehicle and stimulating its use.

MR. L. M. WILLEY has been appointed district manager of the Diehl Manufacturing Company, Chicago, Ill., succeeding Mr. J. R. Marvin. Mr. Willey has recently been connected with the Fort Worth (Tex.) Power and Light Company as manager of the contract department, previous to which connection he was sales engineer with the General Electric Company in Chicago. Mr. Willey is well known in the industry, and in his 15 years' association with the business has made many friends. He is an ardent Jovian, a former Pluto of the Chicago Jovian degree team, a member of the Fort Worth Rotary Club and of the Fort Worth Advertising Association.

MR. THOMAS H. BIBBER has been appointed eastern sales manager of the Adams-Bagnall Electric Company, with headquarters in the Hudson Terminal Building, 30 Church Street, New York, N. Y. Mr. Bibber was for a long time general sales representative of Edwards & Company, Incorporated, manufacturers of electrical house goods, New York. "Tom" Bibber is known from coast to coast in the electrical industry, and the esteem in which he is held and the host of friends and acquaintances upon whom his unique personality has made a marked impression will establish him as a strong element in the Adams-Bagnall sales organization. His territory will include New York, east of Syracuse; Pennsylvania, east of Harrisburg; New England, New Jersey, Delaware, Maryland, Virginia and the District of Columbia. We join with everyone else in wishing him the biggest kind of success.

## OBITUARY.

MR. WALTER R. FOBES, of the Fobes Electrical Supply Company, Seattle, Wash., died at the family home on May 23, after a prolonged illness. Deceased was 39 years old. Mr. Fobes organized the Fobes Supply Company in 1897, and conducted the business until four years ago, when he retired due to ill health.

MR. JOHN G. MACKINTOSH, a director in the Greenfield (Mass.) Gas and Electric Company, the Holyoke Street Railway Company, and the Springfield Street Railway Company, died at his home in Holyoke, Mass., May 23, at the age of 69. He was a native of Tariffville, Conn., and at an early age became employed as clerk and bookkeeper in textile mills. In 1876, he established the banking firm of J. G. Mackintosh & Company, Springfield, Mass., and in 1885, organized the Springfield Safe Deposit & Trust Company, of which he had since been president.

## DATES AHEAD.

National Electric Light Association. Annual convention, San Francisco, Cal., June 7-11. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York, N. Y.

Minnesota Electrical Contractors' Association. Semi-annual meeting, Duluth, Minn., June 10. Secretary, G. M. Jones, 14 Seventh Street, N., Minneapolis, Minn.

Electrical Supply Jobbers' Association. Summer meeting, Hotel Statler, Detroit, Mich., June 15-17. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

Electrical Medical Association of California, San Francisco, Cal., June 15-19. Secretary, H. Scudder, Los Angeles, Cal.

Electrical Contractors' Association of the State of Illinois. Semi-annual meeting, Peoria, Ill., June 25-26. Secretary, E. J. Burns, Rock Island, Ill.

Association of Railway Telegraph Superintendents. Annual meeting, Rochester, N. Y., June 22-25. Secretary, P. W. Drew, 112 West Adams Street, Chicago, Ill.

Society for the Promotion of Engineering Education. Annual meeting, Ames, Iowa, June 22-25. Secretary, F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Northern White Cedar Association. Midsummer meeting, Beaudette, Minn., June 25-29. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

Michigan Section, National Electric Light Association. Annual convention cruise, Steamer *Rochester*, June 26 to 30. Secretary, Herbert Silvester, 18 Washington Avenue, Detroit, Mich.

American Institute of Electrical Engineers. Annual convention, Deer Park, Md., June 29-July 2. Secretary, F. L. Hutchinson, 29 West Thirty-ninth Street, New York, N. Y.

Ohio Electric Light Association. Annual convention, Cedar Point, Ohio, July 20-23. Secretary, D. L. Gaskill, Greenville, Ohio.

National Electrical Contractors' Association of the United States. Fifteenth annual convention, San Francisco, Cal., July 21-24. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y.

American Association for the Advancement of Science. Summer meeting, San Francisco, Cal., August 2-7. Secretary, L. O. Howard, Washington, D. C.

International Association of Municipal Electricians. Annual meeting, Gibson Hotel, Cincinnati, Ohio, August 24-27. Secretary, C. R. George, Houston, Texas.

Pennsylvania Electric Association. Annual convention, Bedford Springs, Pa., September 8-10. Secretary, H. N. Mueller, 435 Sixth Avenue, Pittsburgh, Pa.

Association of Iron and Steel Electrical Engineers. Annual convention, Hotel Statler, Detroit, Mich., September 8-11. Secretary, W. T. Snyder, McKeesport, Pa.

New England Section, National Electric Light Association. Annual convention, Mt. Kineo House, Kineo, Me., September 14-17. Secretary, O. A. Bursiel, 149 Tremont Street, Boston, Mass.

American Electrochemical Society. Twenty-eighth general meeting, San Francisco, Cal., September 16-18. Secretary, Joseph W. Richards, South Bethlehem, Pa.

Illuminating Engineering Society. Annual convention, New Willard Hotel, Washington, D. C., September 20-23. Assistant secretary, Joseph Langon, 29 West Thirty-ninth Street, New York, N. Y.

International Engineering Congress, San Francisco, Cal., September 20-25. Executive secretary, E. J. Dupuy, Foxcroft Building, San Francisco, Cal.

Telephone Pioneers of America. Annual meeting, San Francisco, Cal., September 21-23. Secretary, R. H. Starrett, 15 Dev Street, New York, N. Y.

Southeastern Section, National Electric Light Association. Annual convention, Grove Park Inn, Asheville, N. C., September 22-24. Secretary, George H. Wygant, Tampa, Fla.

# With the Electrical Manufacturers

**Chicago Mica Company,** Valparaiso, Ind., has moved its Chicago office to 212 West Austin Avenue. This removal was necessitated by the steady increase in business requiring larger quarters.

**The Naugle Pole & Tie Company,** Chicago, Ill., announces the opening of an office at 1027 Michigan Trust Building, Grand Rapids, Mich., in charge of H. W. Mitchell. This will make the company better able to serve its customers in that section.

**P. R. Manufacturing Company,** Detroit, Mich., has issued bulletin No. 203 on high-voltage bells from 5 to 12 inches in size that can be used on standard 110 to 125-volt circuits, either direct or alternating current. These bells are specially designed and are of high-grade, rugged construction.

**Hyatt Roller Bearing Company,** Newark, N. J., announces that Charles Ohl, sales manager of the company, formerly in general charge of the New England territory, will henceforth devote himself entirely to roller bearings for electrical machinery and will make his headquarters at the home office at Newark.

**Harvey Hubbell, Incorporated,** Bridgeport, Conn., is distributing to the trade an attractive wall hanger covering the entire line of Hubbell separable attachment plugs and wall and flush receptacles. This is the first time that the entire assortment of bases equipped with the new "T" slots embodying the valuable interchangeable feature has been shown together in one group.

**The Nordberg Manufacturing Company,** Milwaukee, Wis., announces that E. W. Swartwout, formerly of the Chicago office, is now associated with Mr. MacLaren in the New York office of the company. Enlarged offices have recently been taken in the new Equitable Building (120 Broadway), New York. The Chicago office is in charge of John E. Lord.

**Pressed Asbestos Products Company,** 451 West Nineteenth Street, New York City, has prepared a booklet describing Papco, a new material that is acid, water and fireproof and a high dielectric. It has many valuable properties that adapt for valuable use particularly in the electrical field, supplanting objects formerly made of fiber and hard rubber. It is capable of being molded to any desired shape.

**National Metal Molding Company,** Pittsburgh, Pa., manufacturer of electrical conduit, moldings and fittings, has recently opened an office at 801 Electric Building, Buffalo, N. Y., from which to handle its increasing business in western New York and Canada. This office will be in the charge of L. S. Montgomery, who has represented the company in the South and other sections for a number of years and is especially well known in the electrical trade. Mr. Montgomery is a prominent and active Jovian and was Apollo in the Eleventh Jovian Congress.

**The Terry Steam Turbine Company,** Hartford, Conn., announces the appointment of Merton A. Pocock as district sales manager for the territory included in the states of Minnesota, North Dakota and South Dakota. His office is 400 Endicott Building, St. Paul, and this arrangement supersedes the previous selling agreement with Robinson, Cary & Sands Company of St. Paul. The company has also appointed the Hawkins-Hamilton Company, Peoples National Bank Building, Lynchburg, Va., as its representative for the state of Virginia.

**The Brookfield Glass Company,** 2 Rector Street, New York City, has ready a condensed booklet giving dimension diagrams and other data of a few of its standard insulators. Over 30 types are given, also several designs of insulator brackets, hooks, wooden and steel pins. The insulators shown cover the standard pin-type insulator for telephone, telegraph, light and power, and transmission lines ranging up to 20,000 volts. The company modestly points out that its insulators have been on the market for over half a century. Throughout its long career the company has produced insulators for practically every electrical industry and these have been installed by the largest and oldest electrical companies in both North and South America.

**The Hill-Standard Manufacturing Company,** Anderson, Ind., has announced its intention of building and marketing motor-cycles to be propelled by an electric motor. It is stated that the company hoped to be able to put the machine on the market by the first of next April. The new machine will be constructed much on the order of the standard motor-cycle, except as to the engine, and patterns are being perfected for the cycle, which is to be manufactured almost altogether in the local factory. The power is to come from a storage battery, capable of being recharged from an ordinary lamp socket and capacious enough to operate the cycle for 100 miles. The tests of the electrical equipment have been thorough and are said to have proved satisfactory. The wheel is not designed for speed, but for service.

# Record of Electrical Patents

## Issued by the United States Patent Office, May 25, 1915.

**Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.**

**1,140,356. System for Vehicle Control.** J. T. Cade, assignor to Federal Signal Co., Arcola, N. J. Has vehicle-operated alarm along track.

**1,140,357. Shock-Absorber.** W. T. Clark, assignor to Otis Elevator Co., Jersey City, N. J. Elevator worm shaft has electromagnet exerting longitudinal pull.

**1,140,365. Electric Whip.** H. C. Dixon, Oil City, La. Sparks are produced near tip.

**1,140,366. Telephonic Apparatus.** H. C. Egerton, assignor to Western Electric Co., New York, N. Y. Two independently operable receivers having common differential magnetic circuit.

**1,140,378. Selective Signaling System.** E. E. Kleinschmidt, assignor to Hall Switch & Signal Co., New York, N. Y. For telephone train dispatching.

**1,140,386. Ignition Dynamo.** C. T. Mason, assignor to Sumter Electrical Co., Sumter, S. C. Magneto having revolving field magnets.

**1,140,393. Vehicle Signal.** L. O'Brien, Montclair, N. J. Magnetically operated shutter for lights.

**1,140,403. Battery Electrode.** C. B. Schoenmehl, Waterbury, Conn. Plate form; compressed oxide of copper with wire gauge imbedded in both the sides and the edges.

**1,140,408. Centering Device for Electric Switches.** A. C. Smith, assignor to Otis Elevator Co. Adjustable spring means for holding switch in middle position.

**1,140,429. Automatic Valve.** F. E. Woodruff and W. K. Bishop, Binghamton, N. Y. Automatically operated by fuse and at will by electromagnet.

**1,140,432. Armature Spring.** B. Ames, Lowell, Mass. For spark coil.

**1,140,433. Adjusting Post.** B. Ames, Lowell, Mass. For spark coil.

**1,140,434. Synchronizing Apparatus.** C. S. Andres, Philadelphia, Pa. Electrical means for synchronizing phonograph and kinetoscope.

**1,140,446. Advertising Device.** H. J. Cusack, assignor to Thomas Cusack Co., Chicago, Ill. Controlled lamps of different colors throw successive bands of light of different colors on placard.

**1,140,447. Electric Hammer.** A. de Khotinsky, Chicago, Ill. Magnet drives and retracts percussive plunger by different interconnections of its coils.

**1,140,471. Signal-Transmission Means.** J. McFell, Chicago, Ill. Electromagnetically operated number wheels are selectively actuated.

**1,140,477. Self-Winding Clock.** G. H. Myrick, assignor to Minerallac Electric Co., Chicago, Ill. Operation and control of electromagnetically actuated ratchet wheel.

**1,140,491. Switch.** C. J. Anderson, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Circuit-breaker with common trip and closing magnet.

**1,140,492. Signaling Device.** H. B. Anderson, Cleveland, O. Bell having electromagnetically operated clapper.

**1,140,495. Railway Signaling.** J. P. Buchanan, assignor to Union Switch & Signal Co., Swissvale, Pa. Controls signal by track circuit alone or by track and line circuits.

**1,140,498. Socket for Electric Lamps.** C. L. Cassidy, Orange, N. J. Contact-bearing, insulating plug in metal casing from

which it may be removed to give access to connections. (See cut.)

**1,140,545. Motor Controller.** F. P. Townsend, assignor to Cutler-Hammer Mfg. Co. Resistances manipulated in relation to series motor to vary potential on armature and reverse field.

**1,140,579. Switch-Operating Mechanism for Electric Railways.** R. M. Craig, San Antonio, Tex. Track switch shifted electromagnetically and controlled by car member driven according to speed of car and closing circuit at intervals.

**1,140,580. Safety Device for Railroad Trains.** O. M. de Munnick, New York, N. Y. Brakes controlled by circuit through cars, operated when signal is at danger.

**1,140,582. Bracket for Lightning-Rod Points.** T. W. Dodd, assignor to Dodd & Struthers, Des Moines, Iowa. For mounting on roof ridge.

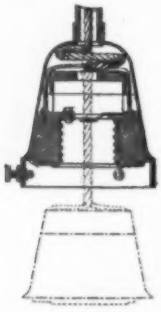
**1,140,587. Device for Centering Trolley Wires.** R. T. Fingado, Mexico. Is applied to track and has mirrors for observing trolley wire.

**1,140,601. Machine for Forming Cementitious Insulating Sheets.** J. E. Lappen, assignor to Union Fibre Co., Winona, Minn. Holding screens carry material through rolls and water is sucked off.

**1,140,603. Insulator Clamp.** W. S. Lee, Charlotte, N. C. Simple sectionalized structure adapted to grip conductor and embrace insulator.

**1,140,623. Cab Signal System.** P. J. Simmen, Los Angeles, Cal. Signal goes to danger if electric energy along track fails at one of several points as car passes these points.

**1,140,658. Telephone System.** P. G. Bernholz, Schenectady, N. Y. Station selection controlled by predetermined different positions of motor-operated indicators.



No. 1,140,498.—Combined Husk and Socket.

**1,140,659. Electrically Operated System of and Apparatus for Automatic Signaling on Railways.** E. W. Bottle, London, Eng. Track switch controls succeeding signal sections.

**1,140,660. Wax-Extractor.** W. J. Brizius, Los Angeles, Cal. Electrically heated point on end of tube through which melted wax is withdrawn.

**1,140,682. Process of Extracting Copper from a Sulphate Solution.** N. V. Hybinette, Christiansand, Norway. Solution electrolyzed to obtain copper and free sulphuric acid.

**1,140,689. Trolley.** M. Lev, Jr., Los Angeles, Cal. Relates to the electrical connection with the wheel.

**1,140,694. Engine-Stop.** G. H. McFeaters, Johnstown, Pa. Gravity valve-controlling device released by electromagnet.

**1,140,701. Protecting Hood for Thermocouples.** A. F. Mitchell, Homestead, Pa. For the hot end in electric pyrometer, permitting contact of couple with object whose temperature is to be measured.

**1,140,739. Polarized Relay.** G. B. Gray, assignor to Automatic Train Control & Signal Co., Pittsburgh, Pa. Detailed arrangement of permanent and electromagnets.

**1,140,749. Selective Switch.** E. E. Kleinschmidt, assignor to Hall Switch & Signal Co. Electromagnetic step-by-step selector.

**1,140,785. Molding Machine.** E. L. Williams, Jr., Santa Cruz, Cal. Includes heating coils for heating the mold and core.

**1,140,788. Mechanical Toy.** B. F. Bain, Pittsburgh, Pa. Car of toy elevator lights electric lamps as it moves up and down.

**1,140,803. Brush-Holder for Motors and Dynamos.** J. B. Cullen, New York, N. Y. Gravity device, common to entire brush gear for pressing the brushes against commutator.

**1,140,816. Sparking Indicator.** C. E. Harlan,, assignor of one-half to W. H. Ames, Watsonville, Cal. Different air pressures supplied to a sparking chamber having windows to observe spark gap.

**1,140,818. Apparatus for Treating Liquids with Ultra-Violet Rays.** V. Henry, A. Helbronner and M. von Recklinghausen, assignors to the R. U. V. Co., New York, N. Y. Liquid passes in thin film about mercury-vapor quartz tubes.

**1,140,819. Apparatus for the Treatment of Water and Other Liquids by Ultra-Violet Rays.** V. Henry, A. Helfronner and M. von Recklinghausen, assignors to the R. U. V. Co. Water is given rotary movement about axial quartz tubes.

**1,140,826. Electrical Battery.** W. Hoppie, assignor to Hoppie Electrical Appliance Co., Salt Lake City, Utah. Dry battery having reinforced container and electrolyte carried by absorbent material and including aluminum chloride and a filler comprising mercurial salts.

**1,140,837. Fire Alarm and Sprinkler-Operating Apparatus.** A. Marcanté, Paterson, N. J. Circuit-closer held open by fusible block.

**1,140,838. Calculator.** C. A. Meilicke, Chicago, Ill. Arrangement of lamp and reflector for illuminating data-bearing rotor in sight opening.

**1,140,843. Transformer.** L. C. Nichols, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Manner of circulating oil for cooling.

**1,140,849. Apparatus for Controlling Motor Vehicles Driven by Mixed Power.** H. Pieper, Liege, Belgium. Gas motor, storage battery and dynamo-electric machine controllable from several points.

**1,140,861. Printing Telegraph Receiver.** J. E. Wright, assignor to Wright Telegraphic Typewriter Co., New York, N. Y. Type wheels governed by permutation slides operated by selective magnets.

**1,140,864. Means for Thawing-Out Water Pipes.** J. M. Aubery, Los Angeles, Cal. Details of resistance heating device placed alongside pipes.

**1,140,880. Adjustable Flood and Spotlight.** W. J. Davis, Jr., and A. P. Nirdlinger, Chicago, Ill. Projector has provision for supporting and connecting electric lamp.

**1,140,893 and 1,140,894. Electric Lamp.** C. H. Fischer, Cincinnati, O. Socket construction in headlight reflector permits adjustment of lamp along reflector axis. Second patent a modification.

**1,140,901. System of Control.** A. J. Hall, assignor to Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Automatic railway-motor accelerating system in which automatic operation may be suspended by operator.

**1,140,917. Outlet Box.** M. Robinson, Newton, Mass. Has adjustable pipe aperture.

**1,140,920. Transformer.** F. Sieber, assignor to Westinghouse Electric & Mfg. Co. Main and supplemental transformers are magnetically insulated but have common secondary winding and independent regulating and auxiliary windings.

**1,140,922. Stationary Inductive Apparatus.** H. C. Soule, assignor to Westinghouse Electric & Mfg. Co. Auxiliary reactance cooled by blast of main air-blast transformer.

**1,140,924. Winding Machine.** C. R. Underhill, assignor to the Acme Wire Co., New Haven, Conn. Electrically operated means for positioning a strand upon a winding mandrel.

**1,140,925. Electrical Measuring Instrument.** T. W. Varley, assignor to Westinghouse Electric & Mfg. Co. Rotary member acted on by field of permanent magnet shifted by circuit windings.

**1,140,926. Regulator for Electric Circuits.** T. Varney, assignor to Westinghouse Electric & Mfg. Co. Regulator operated by two motors of opposed torques which are automatically controlled.

**1,140,937. Air-Valve and Indicating Mechanism.** H. B. Asheiman and J. S. Johnson, Fargo, N. D. An electric annunciator showing condition of valves on a number of pneumatic wheels.

**1,140,946. Compensating Device for Telephonic Circuits.** S. G. Brown, London, England. Coil in receiving element nullifies inductive effect of transmitter on receiver.

**1,140,953. Electric Safety Fuse.** R. C. Cole, assignor to Johns-Pratt Co., Hartford, Conn. Inclosed fuse filled with rotten stone at middle and plaster of Paris and whiting at ends of casing.

**1,140,954. Telephone-Mouthpiece Protector.** L. A. Collins, Louisville, Ky. Diaphragm secured over mouthpiece.

**1,140,957. Circuit-Interrupter.** W. Cooper, assignor to Westinghouse Electric & Mfg. Co. Oil switch with provision for maintaining oil in circulation.

**1,140,961. Circuit-Interrupter.** H. P. Davis and C. Aalborg, assignors to Westinghouse Electric & Mfg. Co. Construction of contacts and insulation of oil switch.

**1,140,980. Coiling Device.** L. E. Haynes, Salt Lake City, Utah. For telephone receiver cord.

**1,140,982. Operating Oil Wells.** W. D. Huff, assignor of three-fourths to L. G. Moss, New Iberia, La. Heat electrically generated below surface of oil in well causes gas to lift column of oil.

**1,140,992. Pneumatic Suction Cleaner.** E. A. Martin, New York, N. Y. Connections and mounting of motor.

**1,140,993. Ignition Dynamo.** C. T. Mason, assignor to Sumter Electrical Co., Sumter, S. C. Movable magnetic member varies flux through windings and interrupter is operated in synchronism with magnetic member.

**1,140,996. Sanitary Telephone Attachment.** T. H. R. Miller, assignor to Myrophone Co., New York, N. Y. Means for securing sanitary material in mouthpiece.

**1,141,023. Automatic Train Stop.** A. G. Turpen, Modesto, Cal. Electrically operates engineer's brake valve.

**1,141,032. Panelboard Fitting.** H. U. Badeau, assignor to Perkins Electric Switch Mfg. Co., Bridgeport, Conn. Sheet-metal cover plate for switches and dial for indicating switch position. (See cut.)

**1,141,047. Signaling Apparatus.** J. F. Duggan, Atlantic, Mass. Indicator at each corner of car operated in response to operations of power controller.

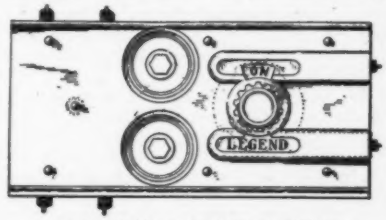
**1,141,052. Spark Plug.** W. H. Gates, assignor to Eastern Machine Screw Corporation, New Haven, Conn. Details.

**1,141,069. Electrical Connection of Pigtail.** A. S. McDaniel, assignor to Corliss Carbon Co., Bradford, Pa. Manner of fastening to carbon brush.

**1,141,074. Voting-Machine Control.** H. O. Rugh, assignor to Railway Electric Mfg. Co., Chicago, Ill. Register-controlling mechanism governed by door-controlled circuit.

**1,141,075. Voting Machine.** H. O. Rugh, assignor to Railway Electric Mfg. Co. Electrically operated and interlocked to prevent improper voting.

**1,141,087. Electric Cloth-Cutting Machine.** N. Komow, assignor to United States Cloth




No. 1,141,032.—Panelboard Fitting.

Cutting Machine Co., New York, N. Y. Motor-driven and includes automatic grinder.

### Patents Expired.

The following United States electrical patents expired on May 31, 1915:

604,712. Electrical Signaling System and Apparatus. W. F. Banks, Milford, Conn.

604,729. Elevated Electric Car Line. J. H. Cooley, Paris, Tex.

604,747. Electric Railway. J. H. Guest, Boston, Mass.

604,770. Pneumatic Attachment for Telegraph Keys. W. J. Lieb, Pratt, Minn.

604,806. Electical Belt. A. J. Taylor, Vineland, N. J.

604,842. Electric Motor or Dynamo. A. L. Riker, New York.

604,843. Former for Winding Armature Coils. A. L. Riker.

604,866. Signal for Electric Railways. W. H. Jordan, Brooklyn, N. Y.

604,874. Safety Device for Electric Carriages. R. T. D. Brougham and W. C. Borsey, London, England.

604,911. Electric Railway. F. D. Sweet, Elyria, O.

604,949. Rheostat for Electric Lamps. R. H. Wapler and F. H. Wapler, New York, N. Y.

604,968. Automatic Current-Distributer for Electric Railways. J. Claret and O. Vuilleumier, Paris, France.

605,013. Switching Device and Circuit Arrangement for Electrically Propelled Vehicles. E. B. W. Reichel, Berlin, Germany.

605,023. Electric Switch for Use With Electrically Propelled Vehicles or Locomotives, Etc. A. T. Snell and C. E. Grove, London, England.

605,026. Globe for Incandescent Lamps. V. de Spruner-Mertz, Brussels, Belgium.

605,066. Third-Rail Underground Electric Railway System. L. E. Walkins, Springfield, Mass.

# Electric Vehicle Section

## Balancer Sets for Economical Battery Charging.

At the meeting of the Chicago Section of the Electric Vehicle Association of America, held at the Hotel Metropole, on May 25, W. H. Noble, of the Lincoln Electric Company, gave a talk on "Charging Vehicle Batteries From High-Potential Direct Current."

Mr. Noble introduced the subject by calling attention to the fundamental relations between the voltage, current, resistance and power in a circuit, giving numerical examples to illustrate these. There is usually a great waste of energy in charging small batteries on circuits of 110 volts or higher. One example was given where low-voltage batteries were charged in such a wasteful manner that for 6.7 kilowatt-hours actually used in the battery, 32.9 kilowatt-hours were wasted in external resistance. In this case only 16.7 per cent of the energy expended was actually used in charging the batteries.

There are three methods of avoiding this difficulty of placing excessive resistance in series with the battery. The first is to use enough batteries in series so that the total voltage approaches the voltage of the supply circuit. This is not usually satisfactory because different cells will need different amounts of charge. A second method is to use motor-generator sets to convert the electrical energy to the proper voltage. This method is satisfactory for small batteries and where a single definite voltage is required, but the cost of the machines makes it objectionable for large installations.

A third method is to use a balancer set and this the speaker considered the most satisfactory method where large numbers of batteries have to be charged. This method was explained in detail.

The idea of a balancer set has been used extensively in lighting and for other purposes, but has not come into general use for battery charging, although it is very well adapted for this purpose. In the simplest case two 110-volt machines are mechanically connected together and electrically connected in series across a 220-volt circuit. The voltage of each machine is 110 volts. A middle wire is taken out between the two machines and the batteries to be charged are connected between this middle wire and one of the outside wires. The largest amount of unbalancing, provided the batteries are connected in the most advantageous combination, will never exceed the charging current for a single battery, which may be, for example, 60 amperes. In this case the capacity of the balancer set need only be enough in excess of 30 amperes to take care of the losses in the machines themselves. For if the unbalancing amounts to 60 amperes, one of the machines will act as a motor, while the machine connected on the same side as the excess battery will act as a generator supplying 30 amperes, and the other 30 amperes will be supplied from the line.

It is evident that the capacity of an installation of this kind can be indefinitely increased by providing additional charging panels only, as it is not necessary to increase the capacity of the balancer set above that required for a single battery. The losses in the machines are nearly independent of the number of batteries charging and consequently the efficiency increases as the number of batteries is increased.

Referring to the example given above, where the loss was 32.9 kilowatt-hours, the corresponding loss for the balancer set would be only 5.9 kilowatt-hours, and this would not be increased if additional batteries were connected, whereas by the method of placing resistance in series the losses are multiplied by the number of batteries charged.

It is not known that this method is in use in any of the garages in Chicago, but it would prove the most desirable method in many cases. Where still higher voltages are supplied, or where lower voltages are needed for charging, the method can be extended by placing three or more machines in series across the line and tapping off between each two machines.

F. E. McCall, who presided at the meeting in the absence of the chairman, pointed out that the initial cost of a balancer set frightens many purchasers because they do not realize that the capacity is so small in comparison to the load. In the case of lighting installations it was his experience that a balancer set with a capacity of only 0.1 to 0.25 of the load was sufficient.

Mr. McCall also read a communication on the subject of greater publicity for electric vehicles.

## The English Electric Vehicle Committee.

A meeting of this committee was held in London, England, under the chairmanship of R. A. Chattock, city electrical engineer of Birmingham, on April 13.

The question of increasing the sales of the committee's *Journal* was considered, the committee feeling that electric supply undertakings (central stations) might do much more in the way of utilizing the *Journal* for distribution among prospective users in their districts. It was resolved to make a further appeal to these undertakings to support the efforts of the committee in this direction. It was reported that many undertakings were restricting their expenditure on publicity material during the war, owing to the regulation of the British Government prohibiting further capital expenditure on ordinary mains extensions and also limiting expenditure generally. It was resolved to point out to the undertakings that the adoption of electric vehicles in their districts did not necessarily require any extension of the mains or plant. The supply was entirely an off-peak load and undertakings on that account should, at the present time, use every endeavor to make known the advantages of electric vehicles. Undertakings are to be asked to make use of the publicity mail cards prepared by the committee, the demand for which has been very small indeed and confined to a very few undertakings up to the present.

Regarding those electric supply undertakings in the London metropolitan area that charge more than two cents per unit for electric supply for vehicles, the secretary reported that he had written asking them to come into line with the committee's recommended tariff of two cents per unit. No satisfactory reply, however, had been received from any undertaking to which the letter had been addressed. It was reported that certain undertakings had found it necessary to advance prices all around, owing to the increased cost of coal, etc.

The committee has had reported to it that there are vehicles not fitted with the standard receptacle which come for charging at certain stations. The committee decided to again advise electric supply undertakings to do what they can to persuade the owners of such cars to have the standard receptacle fitted.

# A Fair Word Helps

THE most convincing evidence of Electric truck efficiency is naturally recorded in the performance of Electric trucks now in operation. Those who use G. V. Electrics, for example, know and admit their superiority over the horse and gasoline truck. Our hardest problem is to interest the man who not only refuses to believe what he cannot see in another city but only half of what he does see ten feet away.

Why is it that many a central station man will concede the successful and economical operation of Electric trucks in level cities, in hilly cities and in foreign lands, but conclude his comments with the contention that he has a very peculiar operating problem and cannot use Electrics? This in the face of the fact that he has never tried them and has no evidence whatever that they will not do his work.

Of course there is no reason why the man who gets his bread and butter from the Electrical industry should purchase Electric trucks because of this fact. But why lead the procession of the prejudiced?

Let's forget this question of whether it is the central station or the Electric truck manufacturer who is at fault in the Electric vehicle promotion, and help to inject a little fair play and harmony into the proposition. A fair word helps.

When you reach the Convention floor why not have your mind receptive, as we shall try to do, and ready to compare notes on the present success of Electric trucks? Surely the present performance and ultimate efficiency of the Electric line truck, the tower wagon, the cable puller and the emergency car are of greater moment than the never-finished angles on the 42 or 60 cells as against 44.

You may find a man (as we have already) who cut the cost of cable pulling from 2.4 cents with hand winch to 1.1 cents with a 2-ton G. V. Something worth while when he pulls over 300,000 feet annually, eh? You may learn how others are saving $10 per day setting poles. There's a mine of information the industry can now have on lamp trimming. See if you can find out what central station paid $94,000 for hauling coal with horses last year. Who was it saved $398 in a short time moving 3000 tons of coke with two Electrics? Give up your figures, not to us but to Electric truck users, and get their figures in turn. We learn much from them and we have had some experience. Forget the truck maker and get some real facts upon which to base your deductions.

If 1000 central station men would in the next six months look for the good points of the Electrics specifically adapted, in the selling, to central station work, we wouldn't need the war stopped to experience a perfect upheaval of transportation ideas in the public utility field. Isn't it worth while to place yourself in a position to really know where Electrics are efficient and where not?

We ask no kinder friends than fair facts.

# GENERAL VEHICLE COMPANY

*Incorporated*

The secretary was also instructed to get into touch with American manufacturers of electric vehicles, pointing out the necessity of fitting the standard receptacle.

As to the standardization of metal-filament lamps for use on electric vehicles, another meeting had taken place between representatives of the Tungsten Lamp Association and the committee's technical subcommittee. On the report of the latter, it was decided to adhere to the previous recommendation that the lamps used should be for a pressure of 12 volts and in accordance with the requirements of the British engineering standards specification No. 69.

## Important Court Decisions Respecting Liability of Garage Owners.

A new and interesting ruling has just been made in the Court of Common Pleas of Cuyahoga County, Ohio, as to the liability of a garage owner because of injury to persons while being driven in their own cars by a driver furnished such persons for hire by the garage owner.

The case was that of Jones versus The Baker Motor Vehicle Company, of Cleveland, Ohio, and it appeared from the evidence that Mrs. Jones was the owner of a car which was kept by the Baker company in its garage as a "boarder" and that upon her call the Baker company would furnish her a driver at a fixed charge per hour and that these drivers were instructed by the Baker company to drive "as directed by the owner" while out with the car. It appeared further that while an employee of the Baker company was driving Mrs. Jones one evening, about dark, and through a drizzling rain, the car ran into a dirt wagon standing by the roadside, without any lantern on it. Mrs. Jones, who had been riding backward, in the front seat of the machine, claimed to have been injured as the result of this collision. The court charged the jury that, as a matter of law, the driver of the car was, at the time of the accident, the agent and servant of the Baker company and that if the company had not exercised due care in selecting a careful driver, or if the driver was negligent and his negligence caused the accident, the company was liable. This ruling of the court is probably the first of its particular kind and if sustained by the higher courts means, as a practical matter, that a garage owner or other person who supplies drivers to the owners of cars, in the manner above described, is absolutely liable not only to the owner of the car but to third parties as well who may be injured through the carelessness of the driver.

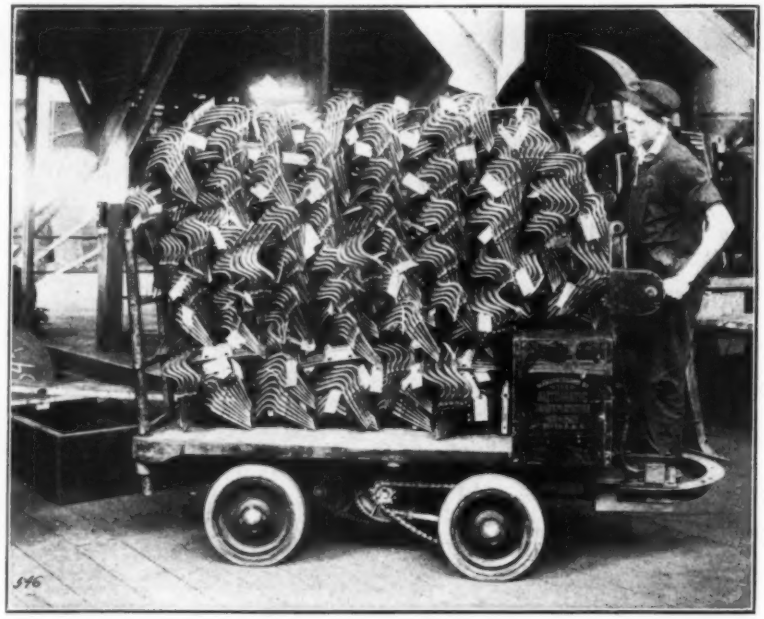
## THE ELECTRIC STEVEDORE.

By A. Jackson Marshall.[1]

That anything as distinctly modern and prosaic as an industrial truck could have a very interesting history seems rather unlikely, yet it is recorded that even the Egyptians and Assyrians had their industrial trucks—of a very primitive type to be sure—but efficient enough to carry some of the great blocks of stone used in building the pyramids. These early conveyances were nothing more than sledges which were dragged along roads smoothed and hardened especially to lessen the friction. Sometimes merely a forked tree limb with boards placed across it for a platform was used as a drag. Later friction was lessened by small rollers used on the sledge runners which in time developed into the wheel and axle—one of man's greatest contributions to world progress. This greatest of all mechanical devices was first used on one of these small vehicles by the Assyrians and soon developed the wheelbarrow and cart.

In America the genesis of the modern electric industrial truck is found in the necessity for an automatic device efficient enough to cope with the ever increasing transportation of baggage and freight and with growing commercial industries. As terminals became larger and baggage rooms, post offices and express depots became longer, a quicker and more capacious truck was demanded, and so one railroad—the Pennsylvania—engaged a mechanical engineer to design an electric hand truck, as it was then called. So successful was this application of the first "Electric Stevedore" that it was shortly applied to other operations.

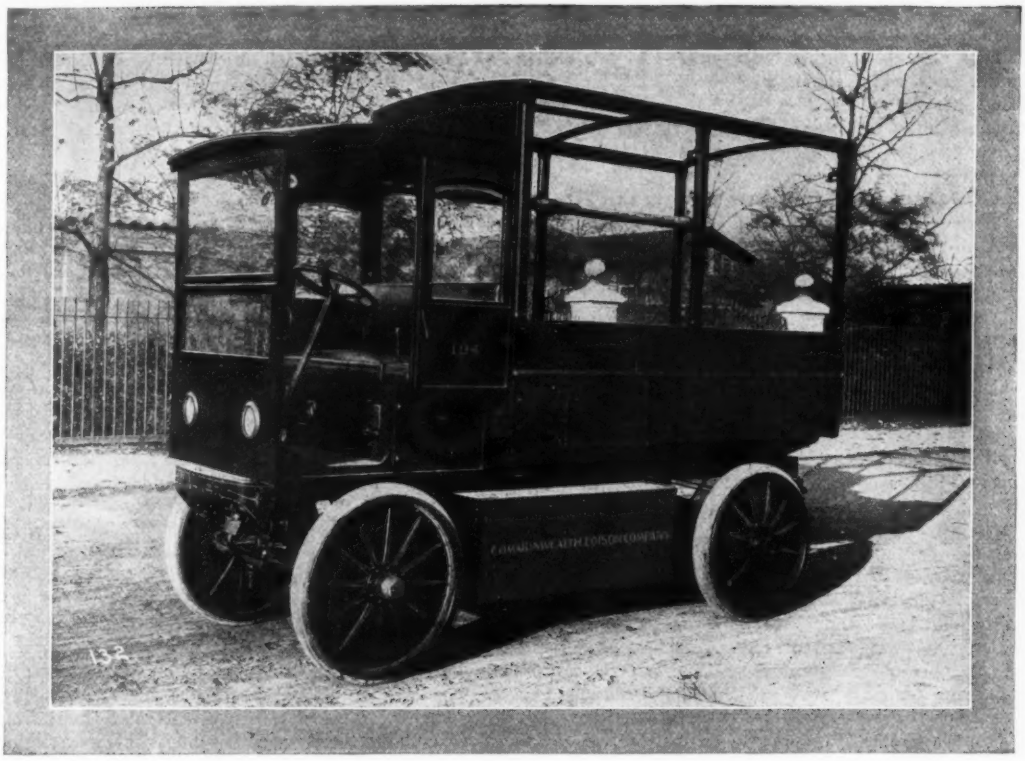
When any mechanical device proves itself a labor and a time saver, combining both efficiency and economy, it is only a short time before it becomes popularized, and beginning with 1911—only four years ago—various developments of the electrical industrial truck followed each other very rapidly. Today over 1,000 of these modern carriers are used in the United States and Canada. The average man has but a small conception of the tremendous amount of work being done on piers, in railroad terminals, in industrial plants by these powerful little storage-battery trucks.



An "Electric Stevedore" at Work.

It is estimated that in the United States alone there is a total of 720,000,000 tons of goods every year which passes through the railroad freight and transfer stations. The present lack of system in handling this freight and the tremendous amount of lost time involved represents a yearly loss of more than $80,000,000. With the existing antiquated and inefficient methods there is constant confusion and delay where thousands of conveyances endeavor to get served within a few hours. This causes the transfer mediums to be held up for several hours inactive with resulting losses. As the use of the "Electric Stevedore" increases, it is to be hoped that this will influence a further systematized manner of delivery. As their work becomes more thoroughly unified, the freight sheds and docks in many cases will operate on a 24-hour schedule. With the virtual free-

1. Secretary of the Electric Vehicle Association of America.



Walker Model L Two-Ton Lineman's Truck with Compartment Body

# Mr. Central Station Manager:

DO YOU realize that ELECTRIC VEHICLES now produce MILLIONS OF DOLLARS income annually to CENTRAL STATIONS during OFF-PEAK load periods?

ARE YOU responsible for your LOSS OF INCOME because your Company does not BOOST AND USE ELECTRIC VEHICLES and practice what you preach to your customers?

LARGE AND SMALL CENTRAL STATION COMPANIES NOW EARN A GOOD PERCENTAGE OF THEIR DIVIDENDS FROM OFF-PEAK VEHICLE CHARGING REVENUE.

WE know HOW they do it and will tell YOU if you just ask us. We will also co-operate with you.

Write now to

## WALKER VEHICLE COMPANY

(Manufacturers of Electric Trucks and Pleasure Cars)

Thirty-ninth and Wallace Streets CHICAGO

534

dom of city streets great electric commercial vehicles operating silently, will transport the goods by night to well located centers from which goods may be distributed the following day and delivered when business houses are prepared for their receipt. This seems to be the only way to solve the problem of congested freight piers in cities where increase in size of the terminals is rendered impracticable for physical reasons, the cities in most cases having steadily built up around them. Today the only hope for decreased congestion is increased efficiency such as will enable street vehicles to discharge or receive their loads with celerity, and this must be effected by speeding up the movement of freight over the platforms, in using more efficient transfer means between the vessel holds or freight cars and the vehicle tail-boards, and in organizing a system of distributing centers to supplement the cramped terminals.

In railway terminals alone where these modern electric carriers have supplanted the hand trucks it is estimated that there is a total saving of 66 per cent. The electrically propelled baggage truck has proved itself a fixed necessity. We have ceased to marvel at the speed, ease and efficiency with which these trucks piled high with trunks, bags and boxes deftly wind their way along congested station platforms from train to baggage room, doing the work that formerly required four times as much labor and twice as many trucks. In fact we have almost forgotten the antiquated old hand truck clumsily pushing its way about congested areas with more strength than system or efficiency. A short description of the operation of an electric industrial truck will show its simplicity and safety. The controller is inclosed and an automatic cut-off switch minimizes accidents. One handle is used as a controller lever, and the other handle for steering. The controller returns to neutral as the hand is removed from the lever. The cut-off switch cuts off the power when the foot is removed from the brake pedal. In other words, the driver applies the brake simply by releasing the pedal with his foot, and as he releases the pedal the power is cut off automatically.

The driver, standing erect on the end of the truck, with hands on the controller and steering lever, respectively, and foot on the brake pedal, is in the best possible position to guide and control his load. The simplicity of operation does away with the necessity for having expensive operators, the average freight-handler being taught to successfully operate a truck, even in congested plants or terminals, in about 48 hours. The ordinary baggage truck has a capacity of 2,000 pounds and is used for carrying both baggage and mail. The immense increase in baggage, express and mail matter being moved by our railroads demanded proportionate increase of efficiency in its handling, and slow moving man-powered hand trucks have gradually given way to the modern "Electric Stevedore."

Time studies made in manufacturing plants and at the great piers in seaport cities indicate beyond a question that "Electric Stevedores" will supplant the hand truck wherever operating conditions warrant. More than this, the shipping platforms and piers of the future will be designed especially for the more efficient operation of these electrics. They already have a tremendous influence on the short haul.

Down in Savannah you may see cotton moved across great piers by "Electric Stevedores" equipped with hoists and cranes, carrying it directly into the holds of the steamers which bring it North. Two of these little electrics would handle more cotton in one day than 20 freight handlers. At the Bush Docks in Brooklyn, N. Y., you can see the same cotton placed in cars by a battery of truck cranes, the cars first being "spotted" by the electric. It is taken out of the cars at the mill by the industrial trucks and moved to storage and then to the spinning room by them. Later the bobbins, dye tubs, and beams are moved from mill to mill by small electric shop trucks.

The *Commercial Vehicle*, in a recent issue, cites an excellent example indicative of the economy of operating these "Electric Stevedores."

"In testimony submitted for the information of the Interstate Commerce Commission, a report of the operation of an electric industrial truck at the Cunard pier, New York City, showed that in handling macaroni in boxes, six electric industrial trucks did the work in nine hours, that would have required 24 hand trucks. The cost of labor with the electric vehicles was $21, while at current longshoremen's rates it would have cost for labor $87.60, if hand trucks had been relied upon.

"In handling grapes in barrels at the same dock, two industrial trucks did the work of 21 hand trucks. In handling mackerel in barrels, two electric industrial trucks did the work of 19 hand trucks. In handling casks of wine, seven electric industrial vehicles with 13 men, did the work of 36 men rolling the casks from one man to the other."

Under the old method of hand truck operation, the cost per ton of handling freight at railroad terminals and steamship piers was 25 cents, while the cost per ton for performing the same work with electrical industrial trucks is but 10⅔ cents. From a socialistic view, too, investigations show an important feature which particularly commends the "Electric Stevedore" to the operator as well as to his employer. Under the old plan the men received a wage of $2 per day, while under the truck operating system, where men are paid on a tonnage basis, their compensation amounted to $2.40 per day, or an increase of 20 per cent.

While the largest field for the "Electrical Stevedore" is in handling baggage and freight at terminals and piers, they are being used to a great extent, however, in factories and industrial plants, and more and larger installations are being made continually. In shop and mill transportation, in storage warehouses, in freight transfer stations, in supply and provisioning work for railroads, steamships, etc., in brick and lumber yards, in stoking in power plants, in wholesale and retail packing, shipping and receiving, and even in building operations the electric industrial truck finds extensive application. A valuable application of the "Electric Stevedore," equipped with a crane, is in laying street curb stones. In warehouses they are used for hoisting, in packing motors, etc. Motor car and other manufacturers are beginning to regard the electric shop truck as indispensable. Warehouses and mills are constantly finding new uses for them as the number of different types increase. The government has adopted them for its arsenals, and a recent special application is found in the new buildings of the Boston Children's Hospital. It is being employed to do the work formerly performed by four men.

It should not be overlooked that this small truck has many of the fundamental advantages of its larger brother in the street, namely: it is clean, odorless, and practically silent, its simplicity of construction is a great aid in operation and maintenance, and its freedom from fire and explosion commends it to fire commissioners and underwriters.

It is obviously too early to determine to the last cent just how much can be saved by the adoption and use of these small trucks. The labor item is the most important one, and it has been found that where the trucks can be kept busy and the hauls average 200 to 800 feet, that each truck will displace at least four, and often five and six men each. They can make from 20 to 30 miles on a single charge, while boosting during noon hour will increase this mileage one-third. Although the initial cost of the electric industrial truck, which is $1,000 to $3,000, looms large when compared to the cost of hand-powered equipment, it will save its first cost in four and one-half months with careful operation, and if a machine will pay for itself in this short time, what does it matter whether it costs $1,000 or $5,000? With work to keep it busy, the economy of the "Electric Stevedore" is little short of amazing.

# QUESTION—

## Has the "Ironclad-Exide" Battery made good?

# ANSWER—

## More than good.

# PROOF—

## Here are a few extracts of letters from owners of "Ironclad-Exide" Batteries that have been in service for three years and over. Read them.

SEND FOR THIS BOOK

"Batteries have been in use since the 1st of January, 1912. We must confess we have been surprised by the length of service we have received from them. Two of the batteries are now giving prectically the same capacity on discharge as they were when they were six months old."

"We now have 24 "Ironclad-Exide" Batteries, two of which have been in daily service for forty-one months. We also have three batteries which are three years old and three which will have been in service three years on November 1, 1914."

"I have had an unusually fine record with "Ironclad" Batteries. I bought a set three years ago last April. In that time I have gotten close on to 25,000 miles."

"In reply beg to state that the set of "Ironclad" Batteries which were in my car when purchased in January, 1912, ran 29,700 miles without one cent of expense for repairs."

"In reference to the "Ironclad-Exide" Battery which I have been using in my Electric for the past three years, will state that this battery has given me exceptional service, and I am told by experts who have recently looked this battery over that it is yet practically as good as new."

"With reference to the "Ironclad" Battery put in our electric truck No. 3, October 4, 1911, will say that the battery has given satisfaction and is still in use."

"The "Ironclad-Exide" Battery, 24 cell, which was one of the first that came to this city, which you furnished me in 1910, and which was put into my Electric, was used three years and four months without any repairs or washing, with a total mileage of about 24,000 miles, and which passed your guarantee in nice shape."

"More than pleased with the results obtained from this "Ironclad" Battery, having received several thousand miles more out of same than we had looked for."

"We are pleased to state that the "Ironclad" Battery that has been in service in our two-ton van No. 6 for over forty months has proven very satisfactory."

***The above statements prove that the "Ironclad-Exide" Guarantee is very conservative.***

***The "Ironclad-Exide" is the most economical battery for Electric Vehicles. Let our office nearest you send you a copy of the "Ironclad-Exide" Testimonial Book, giving the statements of many other users of "Ironclad-Exide" Batteries.***

# THE ELECTRIC STORAGE BATTERY CO.

Manufacturer of

The "Chloride Accumulator", The "Tudor Accumulator"

The "Exide", "Hycap-Exide", "Thin-Exide" and "Ironclad-Exide" Batteries

Boston Atlanta Rochester Cleveland **PHILADELPHIA, PA.** Chicago Denver San Francisco

New York Washington Pittsburgh Detroit **1888-1915** St. Louis Los Angeles Toronto

## Comparative Cost of Garage Service for Gas Cars Equivalent to Standard Garage Service for Electrics.[1]

Securing comparative cost of garage service for gas cars equivalent to standard garage service for electrics, is a task exceedingly difficult and even if successful to any extent produces data purely on untried approximations.

Practically every one is acquainted with the cost of standard garage service for electrics. Equivalent standard garage service for gas cars, which service does not exist at present, would naturally have to be approximated in accordance with those similar factors and conditions common as nearly as possible to both types; electric and gas.

In drawing a comparison such cost data might be divided into the following sub-heads:

(1) Cost per month for storage.

(2) Cost per month for washing and polishing.

(3) Cost per month for gasoline (on a basis of 10 miles per gallon at 14 cents per gallon).

(4) Cost per month for lubrication (on a basis of 300 miles per gallon at 12 cents per gallon).

(5) Cost per month for inspection, oiling and minor adjustments.

(6) Cost per month for hiker service (haul and delivery).

These constitute practically the elements which the electric garage man includes in his monthly standard flat-rate charge.

In Chicago a committee visited 12 prominent garages catering to gas cars and in the majority of instances to those catering to both gas and electric automobiles.

None of these garages has ever attempted to offer service to gas cars on a flat-rate basis, principally because of the many elements so inappropriate to this type which would make such an experiment almost impossible.

In the first place an electric can be driven by almost anyone, but the gas car is purely its owner's car.

The decided difference in the mechanical features of operation would alone make it impossible for what we generally consider as a hiker, to be found who could properly drive each different type and model.

Then again, the difference in the cost of gasoline and lubricating oil together with the cost of electricity for charging, all taken into consideration with mileage and speed makes a comparative figure which may be far from accurate.

However, the committee after conference with many garage men came to the decision that a Cadillac coupe should be chosen as a standard from which to base comparative costs. After visiting 12 garages located north, south and west the committee came to the realization that practically none of such garage men would consider taking the gas car on a flat-rate basis.

In the aforementioned table of cost data these garage owners all agreed on the item of storage at a monthly cost of $35.00; washing and polishing once a week at $4 monthly; inspection service gratis ranging from $1 to $3 monthly.

As to the items of gasoline, lubrication and hiker service, data is merely estimated. For instance, it was claimed by one garage man that the average Cadillac coupe in his garage could not be operated on a flat-rate basis equivalent to service given to electrics for less than $100 a month, stating that storage, washing, polishing and gasoline alone would average from $70 to $80 monthly.

Practically every one of these garage men agreed that from $65 to $80 for these items would be a fair figure. As to the matter of hiker service this factor could never be standard. A number of gas-car owners stated that a hiker for a gas car would mean a thoroughly experienced driver capable of driving any type and any model. Such an attendant could demand from $125 to $200 monthly. This item, of course, would differ, depending upon the sincerity of the garage hiring such an attendant.

In practically no instance could the committee find that the garage man would consider the gas car on less than a $100 monthly charge.

Therefore, from the results of this investigation it can generally be accepted that the present standard cost for garage service of electrics is very reasonable to the vehicle owner and represents practically a 60-per-cent economy for the same service for a gas car if such service were actually possible to obtain.

1 Report made before Chicago Electric Vehicle Association by Fred B. Schafer, Editor of *Electric Vehicles*, Committee Chairman, May 11, 1915.

## Waverley Electric Sociability Run.

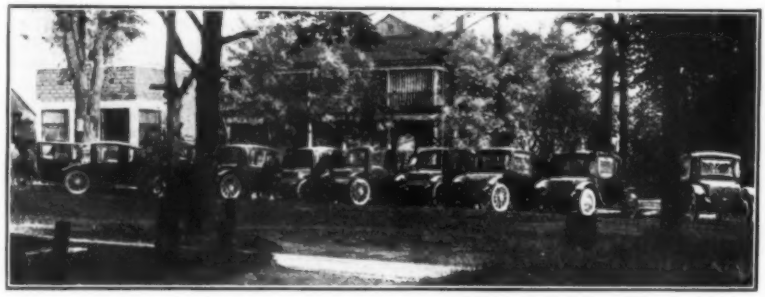
For a 40-mile run in the country, would you choose an electric?

It may seem incredible, yet more than than a score of otherwise sane and sensible people dwelling in Indianapolis, Ind., did that very thing the other day and lived to tell the tale.

Half a score of Waverley electrics, driven by their owners, gathered in front of the Waverley salesroom on Meridian Street, and faced the camera before starting on their unheard-of expedition.

The goal of the expedition was Mooresville, a thriving little city some 20 miles southwest of the Hoosier capital and the idea of it originated with the Waverley management as a part of their new policy of educating Waverley owners to make wider and more general use of their cars.

The use of electrics on country roads has been restricted by a certain timidity on the part of owners who have accepted the designation of the electric as a town car too literally and regarded it as an actual limitation of its usefulness to city streets.



The Waverley Party at McCracken's Hotel.

For this reason the new Waverley management has inaugurated a series of sociability runs to various popular motorists' resorts within easy reach of Indianapolis.

This first round trip of 40 miles was made without a hitch in the schedule. The cars were driven on third speed—a comfortable jog of about 15 miles an hour. No provision was made for charging on the way and none was needed, as all the cars returned with ample current in their batteries for a much longer trip.

The comfort and easy-riding qualities of the Waverley on country roads were said to be a revelation to some of the owners and though seven different models participated in the run, with tires and batteries of widely various types, yet the running qualities of all the cars were remarkably even, so that they kept well together without any apparent effort.

Similar sociability runs will be given by the Waverley company each month this summer.

# Philadelphia

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The Philadelphia Storage Battery Company, during the year 1914 increased its sales over the previous year—Sales during the three months of this year, exceed the same period of any year since the Company has been in business.

The "Diamond Grid" Thin Plates are increasing in popularity.

We make a specialty of vehicle batteries.

The largest manufacturing companies use Philadelphia Thin Plates—

*Anderson Electric Car Co.*
*General Vehicle Co., Inc.*
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## Detroit Electric Will Make Interurban Runs.

Beginning June 1, the Anderson Electric Car Company will make a series of 20 interurban runs from Detroit to points of interest about the city. These runs will extend over a period of 20 consecutive days excepting Sundays. Each run will be made by the same Detroit electric car and on one charge of the batteries. The objective point in each case will be far enough distant to assure a total round trip mileage of at least 60 to 75 miles.

The Anderson Electric Car Company has invited any person in the city of Detroit interested in the performance of the modern electric car to accompany them on any of these trips so that they may actually observe the performance of Detroit electric cars on country roads. In some cases where the objective point does not offer attractive facilities for luncheon, arrangements have been made to take basket lunches so that a pleasant luncheon may be enjoyed along the country road at some inviting spot.

The novelty of a series of runs of this type by an electric car is in itself attractive. Of more interest, however, is the fact that the American people are fast losing their desire for fast driving through the country and long-distance touring. The result of these runs will therefore be awaited with a great deal of interest by many people who desire a conservative automobile for suburban traveling as well as a car for all around city use.

## Boston Motor Vehicle Organizations Merge.

A meeting of the Electric Motor Car Club of Boston was held at the Hotel Thorndike in that city, May 20, with about 30 present. President L. D. Gibbs referred to the recent death of Don C. Tiffany as a distinct loss to the industry. The deceased had been active in the promotion of electric vehicle interests for many years. Resolutions in recognition of his services were read by Secretary C. H. Miles and were adopted by a rising vote.

Mr. Gibbs stated that it had been thought best to consolidate the activities of the club with those of the New England Section, Electric Vehicle Association of America, since the two organizations followed parallel lines of work. It was, therefore, proposed by J. S. Codman, for a committee which had had the matter under consideration, that the Motor Car Club suspend its regular meetings, continuing its present officers until their successors are elected. These suggestions were acceptable to those present, and will be formally acted upon at a future meeting, when amendments to the constitution and by-laws will be voted upon.

Announcement was made of a published list of automobile routes and charging stations in New England, which has been issued by the B. F. Goodrich Company, in co-operation with the club. A vote of thanks was extended to the Goodrich Company for its interest.

La Rue Vredenburgh, of the Boston Edison Company, entertained the gathering with stories and recitations.

## Herbert H. Rice Becomes President of the Waverley.

The Waverley Company, electric vehicle manufacturer of Indianapolis,

Mr. Herbert H. Rice, President, The Waverley Company.

Ind., announces the retirement of President William B. Cooley and the elevation to the presidency of Herbert H. Rice, former vice-president. Mr. Cooley expressed some time ago, a desire to withdraw from active business,

Mr. Wilbur C. Johnson, Vice-President, The Waverley Company.

and the change made May 15 consummates his wish.

The financial strength of the company will not be impaired by the change. New financial support has in fact been gained that solidifies the already substantial foundation of the company's prosperity and gives every reason to expect a considerable expansion of its business in the near future.

Mr. Rice has had an enviable business career. Graduating from Brown University in the class of 1892, he received his training with Colonel Albert Pope in the early days of the bicycle business and was advanced under his inspiring leadership from one important post to another until in 1904 he was sent to Indianapolis to take charge of the Waverley factory then recently acquired by the Pope Motor Car Company.

About the same time, Wilbur C. Johnson, also of the Pope Company, joined the Waverley branch and he now becomes vice-president of the reorganized Waverley company. These two men worked together in the manufacture and sale of Waverley electric automobiles, building up the present extensive plant and business from comparatively small beginnings.

In 1908 they together organized the present Waverley Company, which purchased the factory and good-will from the Pope Motor Car Company, and have actively co-operated in the management of the business since that time.

Both are men of optimistic temperament coupled with sound business judgment, and both look forward to the rapid advance of Waverley interests by their continued united efforts. They have given much of their time and energy to the promotion of the interests of the industry as a whole, having been officers and active working members of the Electric Vehicle Association of America and the Electric Vehicle Manufacturers' Association. Mr. Rice is now serving his second term as president of the National Metal Trades Association, was formerly treasurer of the National Association of Auto Manufacturers, and is now a director of the National Automobile Chamber of Commerce.

Mr. Rice has found time out of his busy career to give much attention to civic activities in Indianapolis, having been president of the Indianapolis Manufacturers' Association, director of the Indianapolis Trade Association and of the Indianapolis Chamber of Commerce, a member of the Board of Trade and other civic and social clubs. He is active in church affairs and in the promotion of local musical interests. One of his favorite diversions is tennis. He plays regularly in both State and Interstate tournaments of tennis players.

An all-around many-sided man of numerous activities and generally high efficiency, the Waverley Company is to be congratulated on his leadership.